

THE AFRICAN GENUS *FERRARIA*

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ABSTRACT

Herbarium material and living plants from their natural habitats were studied for this revision of *Ferraria*, a genus principally concentrated in the winter rainfall region of the Republic of South Africa, with one species widely distributed in Central Africa south of the equator. In order to supplement the morphological diagnostic characters, the leaf anatomy and karyotypes of the species were also investigated.

The genus is subdivided into three sections and ten species are recognised, two of which are new species, namely *F. densepunctulata* and *F. kamiesbergensis*. Illustrated descriptions of the species, their geographical distribution, synonymy, and karyotypes are given. Two polymorphic species occur and are divided into subspecies. Most species are diploid with $2n = 20$; three are heteroploid with $2n = 20$ and 40 , and $2n = 40$ and 60 .

UITTREKSEL

DIE AFRIKA-GENUS *FERRARIA* (IRIDACEAE)

Herbariummateriaal en lewende plante uit hul natuurlike habitats is ondersoek vir hierdie hersiening van *Ferraria*, 'n genus wat hoofsaaklik in die winterreënstreek van die Republiek van Suid-Afrika voorkom, met een spesie wydversprei in Sentraal-Afrika suid van die ewenaar. Behalwe die morfologiese diagnostiese kenmerke, is die blaaranatomie en die kariatipes van die spesies ook ondersoek.

Die genus word in drie seksies ingedeel en tien spesies word erken, waarvan twee nuwe spesies is, t.w. *F. densepunctulata* en *F. kamiesbergensis*. Geïllustreerde beskrywings, die geografiese verspreiding, sinonimie, en die kariatipes van die spesies word aangegee. Twee polimorfe spesies kom voor en word in subspesies ingedeel. Meeste spesies is diploïed met $2n = 20$ chromosome; drie is heteroploïed met $2n = 20$ en 40 , en $2n = 40$ en 60 .

INTRODUCTION

Ferraria is a small African genus of the Iridaceae, tribe Irideae, comprising ten species, with the greatest concentration of species in the western coastal districts of the Cape Province of the Republic of South Africa (R.S.A.). The genus was named by Johannes Burman in honour of Giovanni Battista Ferrari who first described and figured a *Ferraria* in 1633, under the descriptive title *Flos indicus e violaceo fuscus radice tuberosa*. He believed it to come from Batavia.

From the time that Ferrarias were introduced to Europe they attracted interest on account of their unusual flowers having remarkable colour combinations and styles with erect tufts of hair-like processes.

The genus is in need of revision. The last comprehensive treatment of the genus is by Baker (1896) in the *Flora Capensis*, who recognised only six species. After this date several new species have been described.

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Some 50 *Ferraria* binomials are listed in the *Index Kewensis*. Of these 20 have been transferred to various genera, leaving some 30 binomials for the African *Ferraria* species. Nine of these have already been recognised as synonyms, but the remaining binomials are still far in excess of the true number of known *Ferraria* species.

The present revision of the genus is based on external morphological, anatomical and cytological studies. Herbarium material, including the types of the majority of specific names, as well as fresh material collected over the whole geographical range of the genus, has been used for this investigation. Results based on chemotaxonomic research work proved inconclusive, as the supply of seed needed for this type of investigation was inadequate.

MORPHOLOGY

Habit Ferrarias are small to medium sized herbaceous deciduous geophytes varying in height from ca. 70 mm to almost one metre. The plant has an underground stem comprising a row or group of persisting perennial corms to which a new corm is added annually.

The South African species are adapted to winter rainfall conditions. At the beginning of the rainy season (March to May) a bud near the top of the youngest corm, or sometimes one on an older corm, gives rise to adventitious roots and then to a shoot which may flower in winter, spring or early summer (May to November), depending on the species. The base of this shoot gradually becomes swollen with food materials and forms a new corm. After the ripening of the seeds from September to December, the shoot withers.

The only species adapted to summer rains is *F. glutinosa* which occurs in regions north of the Republic. This species puts out a shoot after the spring or summer rains have started, and flowers in summer, usually between November and March.

Roots At the beginning of the growing season up to eight adventitious roots are formed around the base of the developing bud. After development of the new corm these roots are attached to the narrow neck connecting the new corm to the old one. Additional roots are formed from the top internode of the new corm and break through the enveloping cataphyll (Fig. 2).

Should the new corm come to lie too close to the surface of the soil, a thick contractile root develops from its top internode or from the base of the developing shoot, pulling the new corm deeper down and sometimes snapping its connection to the older corm.

Subterranean stem (Figs 1, 2) The underground stems are generally referred to as persisting corms. Lewis (1954, p. 72) considered this stem to be a "tuberous corm . . . which probably represents a transition stage from a rhizome to the type

of corm . . . (found) in many genera of the Iridoideae, such as *Hexaglottis*, *Moraea*, etc. (and which) differs from all others in the family in having no persistent scale leaves or tunics, and is actually more in the nature of a tuber''.

The mature corm is covered with a brown cuticle ca. 5 μm thick comprising two fused layers, the inner being the cuticle of the corm epidermis, and the outer that of the adaxial epidermis of the sheathing cataphyll initially covering the developing corm (Fig. 2). In the older corm this cuticle is the only part of the sheathing cataphyll(s) that is left. Remains of vascular bundles and adaxial epidermal cells impregnated with tannin, are still present in younger corms. This epidermis remains meristematic for a longer period than other tissues of the cataphyll, dilating with the corm and keeping it covered for some time.

As part of the cataphyll, albeit very thin, still remains, I shall continue to use the term *corm* for the subterranean stem of *Ferraria*.

Nowhere is the corm surface covered with cuticles of more than one cataphyll. The adaxial epidermis of the lowest cataphyll which is attached to the base of the corm, covers and fuses with the surface of the large basal internode of the corm. At the second node the upper part of this cataphyll withers completely and disappears. Here the adaxial epidermis of the second cataphyll fuses with the second internode of the corm (if such is present). Above the third node, if present, the epidermis of the third cataphyll is the only persistent cover of this region.

Dry corms that have not yet sprouted are able to absorb a little water at the beginning of the rainy season. Their water absorbing capacity varies from about 1% to 3% of the corm's mass.

The annual development of a new corm and the perennial nature of the older corms result in the formation of a row of corms (Fig. 1) which may be arranged vertically or, in the case of *F. ferrariola*, obliquely or almost horizontally. The corms are connected to each other by a narrow neck in which several vascular strands converge and which later becomes somewhat suberised.

The corm comprises one to several internodes. Its bulk is formed by the basal internode of the shoot, and in species with large corms, e.g. *F. divaricata*, *F. crispa* and *F. foliosa*, by two to three internodes. The upper internodes are short. The nodes are evident on the corm surface as fine circular lines.

Internally the corm is composed of a hard horny storage tissue of colourless parenchyma consisting of more or less isodiametric cells packed with large and small, simple starch grains. Oil globules occur in the epidermis and subepidermal layers. The epidermis has a thick outer cellulosic cell wall ca. 10 μm wide below the cuticle, and elongated pits in the anticlinal walls. The cell walls of the ground tissue are 4–5 μm wide and are pitted. Vascular bundles spread throughout the corm and converge towards the base and top. A distinct central stele is absent. The xylem comprises mostly annular, spiral and scalariform vessels. Large styloids occur singly in narrow elongated idioblasts, interspersed among the storage cells and concentrated towards the base of the corm.

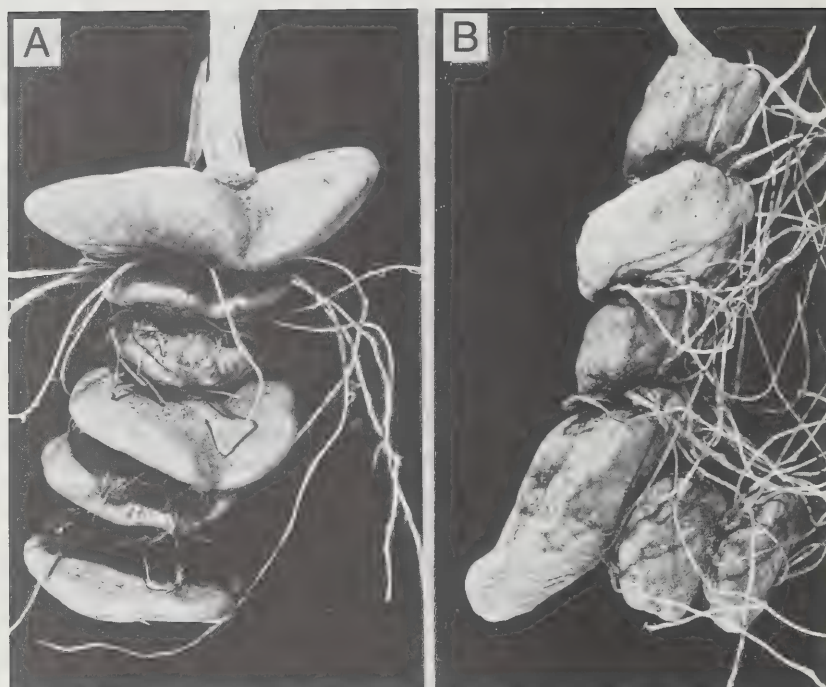


FIG. 1.
Corms of A, *Ferraria uncinata* and B, *F. ferrariola*. $\times 1,2$

F. crispa and *F. foliosa* sometimes form offshoots in the form of underground stolons, from a bud near the top of a young corm. In sandy ground the stolon may attain a length of 100 mm, giving rise at its tip to a young corm from which a shoot will develop in the following year.

Shortly after the start of the cultivation of *Ferrarias* in England, it was found that corms may rest for longer than a year without sprouting, even under favourable conditions. Miller (1759a) remarked: "There is great singularity in the Root of this Plant: For it does not vegetate annually, as most others do; but, on the contrary, lies inactive every other Year; and sometimes it will remain two Years without putting out either Leaves or Fibres; and during that time it will be perfectly sound and fair." Andrews (1803) also drew attention to this interesting feature.

Resting periods of more than a year have now again been observed under horticultural conditions, in several species such as *F. uncinata* and *F. divaricata*; but they do not occur as regularly as observed by Miller. This phenomenon

The African genus *Ferraria*

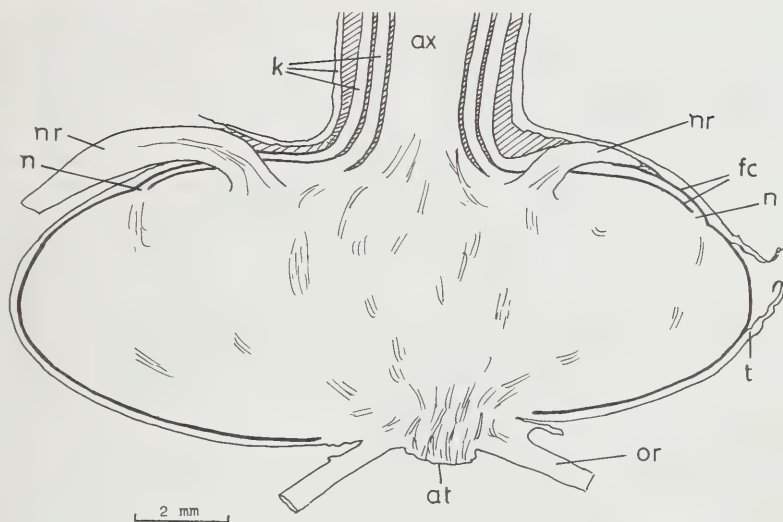


FIG. 2.

Median longitudinal section through young corm of *Ferraria divaricata*: at, attachment to older corm; ax, aerial axis; fc, fused cuticles of tunics and corm epidermis; k, cataphylls, the bases of which form the tunics; n, node; nr, new root emerging; or, old root of previous season; t, disintegrating tunic.

probably also occurs in their natural habitats. It may be an adaptation to drought conditions, a feature which often occurs in the habitats of these plants.

The corms are asymmetrical or almost symmetrical, depressed globose, conoidal, obliquely ovoid, or irregular in shape (Fig. 1). They have, however, little diagnostic value, as variation in size and shape occurs within single species, e.g. in *F. foliosa* they are depressed globose to conoidal, the size and shape depending on the age of the plant, and also to some extent on environmental conditions such as soil texture and available moisture. The size varies from ca. 10 to 35 mm in diameter and rarely, e.g. in *F. foliosa* and *F. schaeferi*, to 50 mm or 60 mm. The corms in the group often range from small older corms to larger new ones, the size being proportional to the size of the shoot, which again depends on the age of the plant and prevailing environmental conditions. Occasionally a small corm occurs between two larger ones, indicating an unfavourable growing season.

The corm of *Ferraria* corresponds with that of *Hexaglottis*, *Homeria*, *Gynandris* and *Moraea* of the tribe Irideae in lacking a distinct central stele and in most of its roots emerging from the upper part of the corm. It differs in several respects: in being perennial and almost naked; in often consisting of more than one internode; in being formed from the basal internode(s) of the aerial axis. (The

corm of *Hexaglottis*, etc. is formed by an axillary bud, the aerial axis dying down completely at the end of each growing season, f. De Vos, 1977; Lewis, 1954). In the above-mentioned features it resembles the *Watsonia* type of corm of the tribe Ixieae (De Vos, 1977), but differs in being almost naked and perennial, and in lacking a central stele.

The *Ferraria* corm is indeed an intermediate stage, as Lewis (1954) already stated, between the rhizome of genera such as *Bobartia* and *Dietes*, and the tunicated annual corms of *Homeria*, *Hexaglottis*, *Gynandriris* and *Moraëa*.

Aerial axis A shoot usually develops from the top axillary bud on the corm of the previous year. This bud is often situated somewhat above the node. In young plants that have not yet flowered, the apical bud of the corm forms the new shoot. Large corms with several internodes, such as *F. foliosa* and *F. divaricata*, may form shoots over several years, at first from axillary buds and later, when these have been depleted, from adventitious buds which develop and sprout. This can result in a branching of the corm group.

The aerial stem is from 50 mm to almost 1 m in length and consists of few to numerous internodes. It is laxly or more often densely and repeatedly branched in its upper part to form a small to large corymbose inflorescence. In most species it is densely covered with foliage leaves, exceptions being *F. glutinosa*, *F. ferrariola* and *F. densepunctulata*. In the former a viscid zone occurs below each node and the leaf bases sheathe only a small portion of the long slender internodes. In the last-mentioned two species the stem is short and compact, the leaf bases sheathing the greater part of each internode.

Leaves The leaves are generally equitant and in distichous sequence, but in *F. foliosa* and in the upper parts of larger plants of *F. crispa* and *F. schaeferi* they are spirodistichously twisted.

One to three cataphylls occur at the base of the shoot, attached to nodes below and on the developing corm. They are 15 to 120 mm, and rarely to 200 mm long, and consist of bifacial sheathing leaf bases only. In its lower half the two margins of a cataphyll are fused to form a cylindrical sheath around the corm and base of the shoot. The top of the upper cataphyll appears above-ground and is green and, in some species, spotted or mottled purplish-red. Irregular purplish-red spots are distinctive in *F. ferrariola* and help in identifying this species.

The foliage leaves are few to numerous and are cauline, developing from nodes on the aerial stem above the corm. They consist of large bifacial amplexicaul leaf sheaths and long or short, unifacial blades which are firm in texture, often glaucous and somewhat xeromorphic. The blades are usually narrowly ensiform to linear and sometimes swollen in their median zone (e.g. *F. crispa*, *F. schaeferi*), or compressed cylindrical (*F. ferrariola*, *F. densepunctulata*). *F. brevifolia* has distinctive short, obliquely ovate leaf blades which are much shorter than the leaf sheaths. In *F. foliosa* the unifacial parts of the leaves are also short compared with the large bifacial sheaths.

The leaf margins are cartilaginous, firm and often pale green or yellowish green in colour. They are smooth, except in *F. uncinata* where at least some leaves have finely crisped margins. In some species, such as *F. brevifolia*, the margins are strongly thickened; in others, e.g. *F. densepunctulata*, the marginal thickening is almost indistinguishable in fresh material. The leaf tip is obtuse to acute and often incurved; this feature varies within most species.

Young plants, not having yet reached the flowering stage, possess one or two long, very narrow, unifacial leaves, which are often rhomboidal or sometimes almost cylindrical in cross section (e.g. *F. foliosa*, *F. crispa*, *F. densepunctulata*). They have at their bases a much reduced, closed leaf sheath which covers the abbreviated axis.

Leaf anatomy. Anatomically the leaves of the species of *Ferraria* differ only in minor details, such as in the amount of colourless mesophyll, the position of the veins, and the presence of epidermal papillae (Fig. 3).

The epidermal cells are somewhat dome-shaped in transverse section, mostly 30–40 μm in height; in costal areas of *F. schaeferi* and *F. densepunctulata*, however, they are up to 70 μm high. The outer cell walls comprise a thick cellulosic layer of 4–8 μm (up to 12 μm in *F. schaeferi*), covered with a thin cuticle only ca. 1 μm in thickness.

In several species of section *Macroscyphae* each epidermal cell has a centrally placed papilla on its surface, formed by a small evagination of the outer cell wall. These papillae are 18–20 μm in diameter and vary in height from ca. 10 μm in *F. brevifolia* and *F. kamiesbergensis* (which is occasionally without papillae) to ca. 20 μm in *F. uncinata*. In subspecies *macrochlamys* of the latter species papillae on the costal areas are elongated into one-celled trichomes 60–80(–100) μm long. The cell lumen and cytoplasm of the epidermal cell extend up into each hair. In section *Ferraria* only *F. schaeferi* occasionally possesses papillae. Here each papilla occupies the width of an epidermal cell, being 40–45 μm in diameter and to 10 μm in height; they appear to be solid thickenings of the outer cellulosic cell wall, covered with the thin cuticle.

Stomata are confined to intercostal areas where they alternate regularly with elongated epidermal cells. They are sunken and lack subsidiary cells. The guard cells are usually 30–40 μm long, but in the hexaploid *F. crispa* they measure to 50 or 60 μm .

The mesophyll comprises three or four layers of palisade tissue below the epidermis on each side, and a central colourless parenchymatous tissue of large thin-walled water storing cells with minute intercellular spaces. A spongy layer is lacking. In section *Ferraria*, as well as in *F. ferrariola*, this layer is swollen in the median zone storing a larger amount of water. As the habitat of these species is the dry sandy regions of the west coastal belt, they are probably often in need of a water reserve.

Both margins of the leaf blade are furnished with a strong bundle of

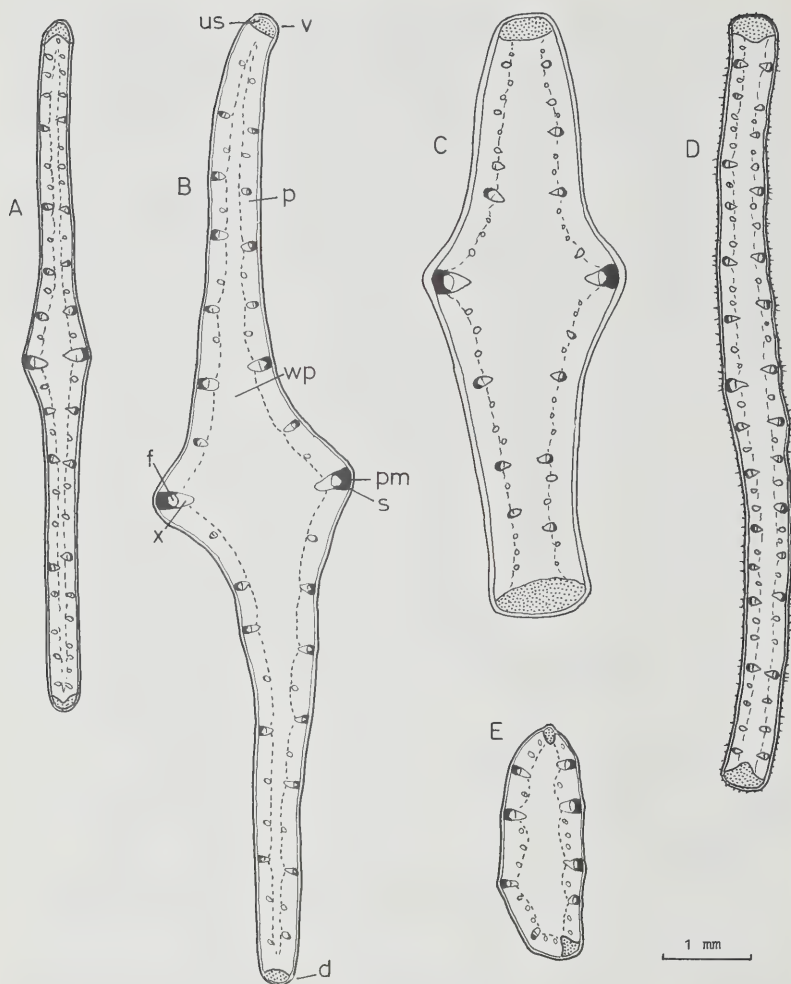


FIG. 3.

Transverse sections of leaves of *Ferraria* species, taken about halfway up the leaf blade. A, *F. glutinosa*; B, *F. crista*; C, *F. schaeferi*; D, *F. uncinata*; E, *F. ferrariola*; d, dorsal margin of unifacial leaf blade; f, phloem; p, palisade chlorenchyma; pm, "pseudo" midrib; s, sclerenchyma; us, unignified marginal sclerenchyma; v, ventral margin of unifacial leaf blade; wp, colourless waterstoring parenchyma; x, xylem.

unlignified fibres, each fibre about 1 mm in length and 7–10 μm in diameter, with tapering ends and thickened cellulosic walls. The dorsal margin of the unifacial leaf blade represents the midrib of the bifacial leaf sheath but lacks a large vein; the ventral margin represents the two "fused" margins of the sheath. The crisped leaf margins of *F. uncinata* are due to an excessive elongation of the marginal fibres.

Tannin containing idioblasts occur in the colourless parenchyma in the neighbourhood of veins in *F. glutinosa* and *F. ferrariola*.

Two larger veins, forming a pseudo-midrib, occur in leaves of *F. glutinosa*, *F. ferrariola*, and species of section *Ferraria*. They lie more or less opposite each other on either side of the colourless parenchyma tissue (Fig. 3A, B, C). Every large and medium sized vein has a bundle of lignified fibres against the phloem. In most species of section *Macroscyphae*, as well as in *F. densepunctulata* of section *Ferraria*, a single layer of parenchyma, which is part of the bundle sheath, occurs between the sclerenchyma and the epidermis. In three species of Section *Ferraria*, as well as in *F. ferrariola*, the sclerenchyma of the larger veins lies against the epidermis.

Numerous styloids, typical of the Iridaceae, occur in subepidermal longitudinal rows in the costal zones. They lie singly in narrow elongated idioblasts, and are 50–120 μm long and 8–18 μm wide, and square, or sometimes rectangular, in cross section.

The phloem is composed of a few sieve tubes with companion cells, except in *F. glutinosa* where in addition some phloem fibres occur in large veins. The xylem comprises annular, spiral, and pitted vessels with transverse pits, embedded in a small mass of xylem parenchyma. The vessels of the large bundles vary greatly in size and are up to 50 μm in diameter. Anastomosing bundles between the parallel veins are small and infrequent.

The leaf anatomy indicates a close relationship between *F. uncinata*, *F. brevifolia* and *F. kamiesbergensis*, and also between *F. crispa*, *F. foliosa* and *F. schaeferi*. It further shows that *F. ferrariola* is intermediate between sections *Ferraria* and *Macroscyphae*; and that *F. glutinosa* shows a closer affinity to section *Ferraria* than to section *Macroscyphae*.

Inflorescence The branched upper part of the aerial axis constitutes a dense, or rarely lax, corymbose inflorescence composed of few to numerous suberect, cylindrical cymes. These are borne at the ends of the branches and branchlets, subtended by the short bract-like upper leaves. Each cyme generally contains two flowers enclosed in two large, green, opposed bracts or spathes. As an exception three flowers may be present, and in *F. glutinosa* up to six flowers per cyme are normally produced.

The two spathes are firm in texture and imbricate, both encircling the flowers completely. They show numerous parallel veins, pale or sometimes reddish membranous margins, and are often keeled, with their tips somewhat hooded. The

outer spathe is generally ovate and always shorter than the inner which is lanceolate and (30-)40-70(-90) mm long. Between the two flowers in the cyme a single semi-hyaline, shortly lanceolate bracteole (prophyll) is present, ca. 20-30(-50) mm in length. It envelops the younger flower while still in the bud, and is placed with its dorsal side against the older flower.

The basal internodes of most axillary branches are much reduced, so that two cymes are often congested in the axil of a single bract-like foliage leaf. The cyme nearer the subtending leaf represents the primary axillary branch and the other, nearer the main axis, a secondary branch. The latter is in the axil of the first leaf of the primary branch, which is in the form of a prophyll addorsed to the main axis.

Flowers open consecutively, but in large plants flowers from more than one cyme may be open simultaneously. The terminal flower is the first to open, followed by the terminal flower on the lowest axillary branch. The third flower to open may be either the second flower of the top cyme or a flower on the second axillary branch. Flowering continues for several weeks in the case of large plants of *F. crispa*, *F. foliosa* and *F. schaeferi*, while the inflorescence progressively enlarges by further branching.

At anthesis the perianth, stamens and style branches are exerted, usually from one side of the cyme near its top; the ovary remains sheathed by the spathes till the ripening of the capsule, except in *F. glutinosa* where the small ovary is already exerted at the flowering stage.

Flower The regular flowers are erect or suberect, on pedicels ca. 15-20 mm in length. They vary in length from (30-)35 to 60(-80) mm and in diameter from ca. 35 to 60 mm. They are mostly short-lived, anthesis lasting less than a day in species of sections *Glutinosa*e and *Ferraria*, except for *F. densepunctulata* whose flowers remain open for two days. In section *Macroscyphae* the flowers of most species remain open for two days, but in three species variation occurs: flowers of *F. uncinata* and *F. ferrariola* remain open for two to three days, while those of *F. divaricata* stay open for one to three days.

The flowers of most species emit a scent. *F. foliosa* has an unpleasant mouldy, and *F. crispa* a very unpleasant putrid odour. Both attract flies. The scent of *F. divaricata* too is usually strong and rather unpleasant and has been described by Ker (1804) as not unlike that of fresh olives. Some species, e.g. *F. brevifolia*, *F. kamiesbergensis* and *F. schaeferi*, are sweetly scented.

Nectaries As in other genera of the tribe Irideae, the nectaries of *Ferraria* are superficial on the adaxial side of the claws, at or near their bases. Those on the inner claws generally lie in a median adaxial groove. The abundant nectar exuded lies exposed on the surfaces of the nectaries.

The size and position of the nectaries are specific for most species of *Ferraria*; but unfortunately they are hardly discernible in herbarium specimens. In section *Ferraria* the nectaries are bilobed or sometimes trilobed, often shallowly concave, ca. 2-4 × 3-6 mm in size (often wider than long), and usually

occupy a large part of the lower half of each claw. They are placed from one to a few mm above the claw bases (up to 7 mm above the bases in *F. densepunctulata*). In section *Glutinosae* the nectaries lie 2–5 mm above the claw bases, but in most species of section *Macroscyphae* they are basal or almost basal, usually minute and sometimes hardly discernible even when fresh. An exception is *F. divaricata* which has larger nectaries, those on the inner claws often being a few millimetres above the claw bases.

Pollination is mainly brought about by short-tongued insects like flies, blue bottles, and small beetles which are attracted by the scent and copious amounts of nectar. Pollination of *F. undulata* has been described by Scott Elliot (1891), who named three species of flies attracted to the flowers.

Perigone The perianth segments, ca. 25–40(–50) mm long and 5–10(–20) mm wide, are free and subequal, with the three outer segments somewhat larger than the inner.

The claws are suberect and form a ‘cup’ 8–15(–20) mm deep and 6–15(–20) mm in diameter at the rim. It is widely bell-shaped with a rounded base and often with narrow slits between the claw margins in section *Ferraria*; and narrowly funnel-shaped with a narrow angular base and usually overlapping margins in most species of section *Macroscyphae*. The claws of the outer segments are broader than those of the inner and have thin, almost hyaline margins and a swollen median zone. The margins of the inner claws are swollen, thus forming a median adaxial groove in which the nectaries are situated.

Soon after the opening of the flowers the perianth limbs become strongly reflexed—whence the popular name ‘spinnekopblom’ (spider flower) for several of the species. The limbs have finely or roughly crisped or undulate margins and are generally much longer than the claws, except in two subspecies of *F. divaricata* where they are equal to, or slightly shorter than, the claws. The tips are incurved, acute to acuminate, and, in several species of section *Macroscyphae*, attenuate, tapering to a fine point. With age the tips curl inwards over the style and anthers, thus closing the flower. After closing, some autolysis takes place in the perianth and a drop of liquid forms inside the closed perianth.

A remarkable range of flower colours and colour combinations occurs in the genus. In several species of section *Macroscyphae*, namely *F. brevifolia*, *F. kamiesbergensis* and *F. divaricata* subsp. *aurea*, the colouring is more or less constant, being of a very pale yellow or bright yellow, with the margins of the limbs often a slightly darker yellow or orange-yellow, and the outer segments often dotted with green. A wide variation in colouring occurs in several species: in *F. crispa*, *F. schaeferi* and *F. glutinosa* the colours vary from pale yellow or cream, with dark brown spots and blotches, to the opposite: dark brown, maroon or almost black, often with pale spots and blotches; the crisped margins are greenish or yellowish-brown.

The perianth of *F. uncinata* varies from bright or dark blue or purplish blue

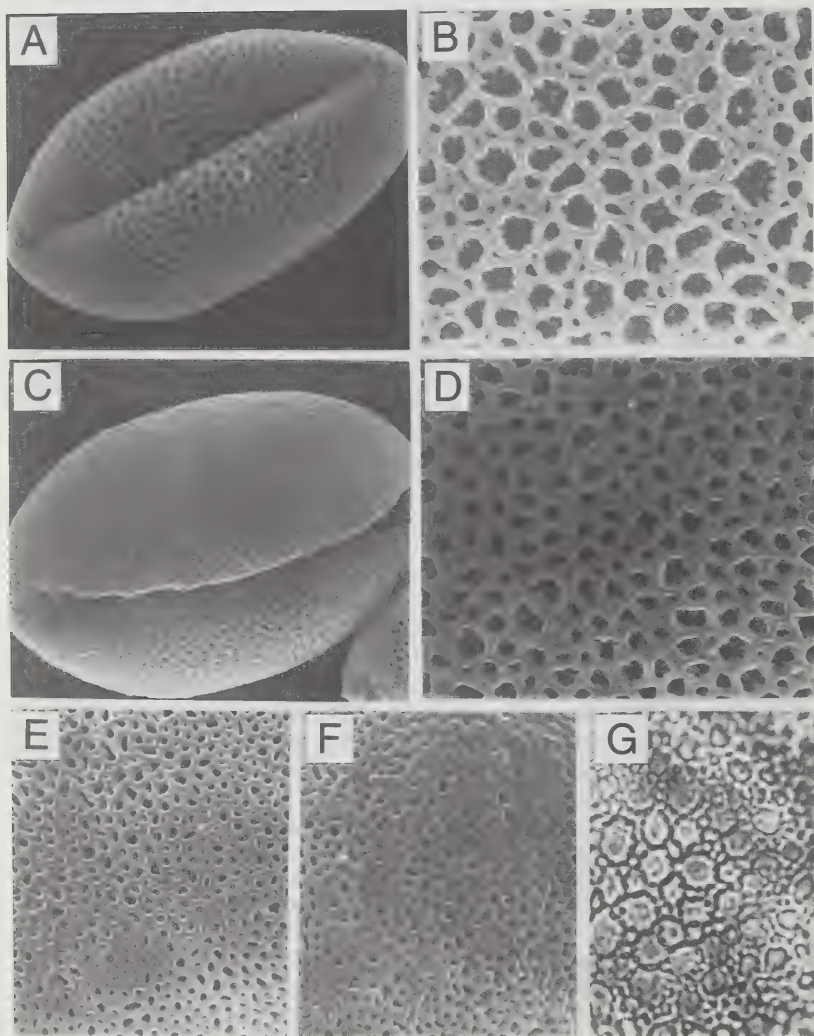


FIG. 4.

Scanning electron micrographs of *Ferraria* pollen. A, B, *F. crispa*; C, D, *F. divaricata*; E, *F. ferrariola*; F, *F. glutinosa*; G, *F. crispa*, light micrograph to show simplibaculate reticulation; A $\times 960$; C $\times 1\,100$; B, D–G $\times 2\,600$.

with narrow or wide, greenish yellow margins, to pale yellow in subspecies *macrochlamys*. In *F. ferrariola* the perianth varies from greenish white to pale greenish yellow or pale blue, and the outer segments have distinctive short dark stripes. Flower colours are recorded with RHS numbers (from the colour chart of the Royal Horticultural Society).

Androecium The length of the filaments and style varies with the depth of the perianth cup, thus generally placing the anthers and stigmas above the rim of the cup.

The filaments are inserted at the base of the perianth and are fused to form a slender erect cylindrical tube (6–)8–12(–20) mm in height. They are free at the top for 1–4 mm, where they are slightly flattened and have a shallow adaxial groove. Here they are widely patent, thus placing the anthers in a horizontal or almost horizontal position, appressed to the style branches.

Young anthers of newly opened flowers possess two long parallel thecae 3–6 mm in length. After dehiscing longitudinally, they shrink within three or four hours to about half their original length. The anthers are versatile; in section *Macroscyphae* they are attached above their middle to the filaments and later the two thecae divaricate widely (Figs 5C, D, 6D). In sections *Ferraria* and *Glutinosae* the anther is attached at or just below the middle, and the anther lobes remain parallel (Figs 5A, B, 6B). In *F. ferrariola* divarication of the lobes is slight (Fig. 6F) and occurs later than in the other species of section *Macroscyphae*, so that the anthers of this species seem to vary from parallel to divaricate.

The pollen grains are monocolpate and vary in length from 65 to 106 μm , in the dried condition mounted in Canada balsam. The colpus is slightly shorter than the grain and is edged with a smooth rim ca. 2 μm wide (ca. 3 μm in the hexaploid *F. crispa* and *F. schaeferi*). The grains show a reticulate sculpture (Fig. 4), with muri composed of single rows of pila. In section *Ferraria* the reticulum is strongly heterobrochate (Fig. 4A, B), the brochi (lumina) varying in single grains from 1 μm to 5 or 6 μm in diameter. An almost regular pattern is formed where larger brochi are surrounded by a ring of smaller ones. Towards the two ends of the colpus the brochi are small in *F. crispa* and almost uniform in size. In sections *Macroscyphae* and *Glutinosae* the reticulation is finer (Fig. 4C–F), with brochi more uniform and from less than 1 μm to 3 μm in diameter. The finest sculpturing occurs in *F. ferrariola* and *F. glutinosa* (Fig. 4E, F).

Gynoecium The ovary is generally slender and (12–)15–40(–60) mm in length. It is somewhat triquetrous and ca. 3 mm in diameter with a narrow base and tip. The only exception is *F. glutinosa* which has a shortly club-shaped or ellipsoid ovary 5–8 mm long.

In section *Macroscyphae* the ovary tapers at its top into a filiform sterile rostrum or beak (8–)10–20 mm long and about 1 mm in diameter. The three ovary chambers run up through the rostrum into the base of the style where they coalesce to form a single style canal. No vestiges of ovules occur in the rostrum. The only

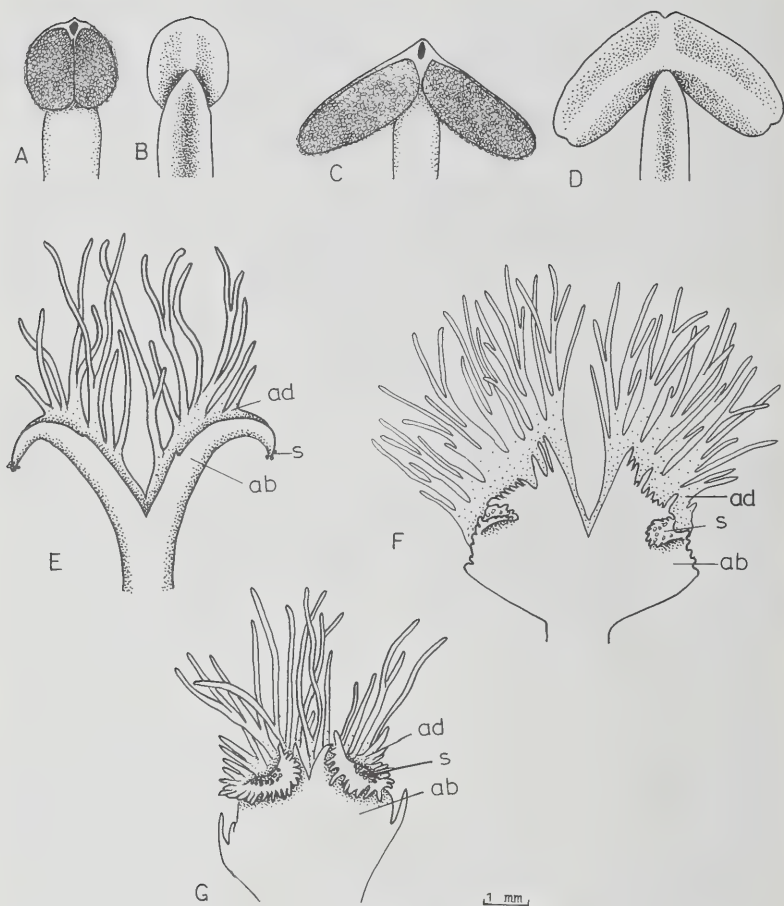


FIG. 5.

Stamens, style branches and stigmas of *Ferraria* species. A, B, *F. crispa* stamen: A, abaxial side, B, adaxial side; C, D, *F. divaricata* stamen: C, abaxial side, D, adaxial side; E, F, G, one style branch, lateral view of: E, *F. densepunctulata*; F, *F. divaricata*; G, *F. ferrariola*; ab, abaxial margin of style branch; ad, adaxial margin; s, stigma.

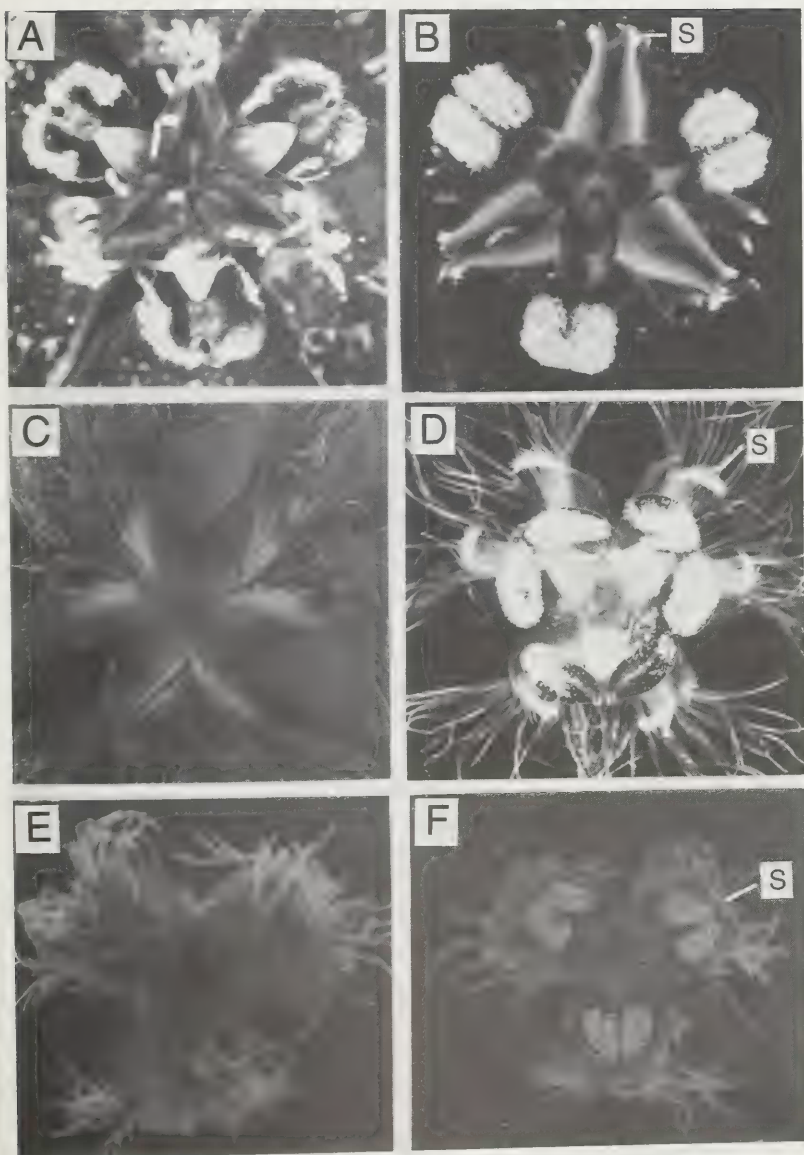


FIG. 6.

Style branches, stigmas and anthers of *Ferraria* species. A, B, *F. crispa*; C, D, *F. divaricata*, E, F, *F. ferrariola*; A, C, E, top view; B, D, F, seen from below. s, stigma; ca. $\times 5$.

other rostrate species is *F. schaeferi* of section *Ferraria* which has a short rostrum not more than 8 mm long. The other three species of this section also have a sterile top without ovules, 5–6(–7) mm long, but these ovaries are not described as rostrate, as the top is not filiform as in section *Macroscyphae*.

The style is (8–)10–15(–25) mm long. Above the filament tube it divides into three short spreading, bilobed or bipartite branches placed opposite the anthers. The six lobes or arms are fimbriate along their upper edges, and the fimbriae, mostly 4–6 μm in length, form an erect, usually dense tuft in the centre of the flower (Fig. 6).

Each style lobe or arm has two parallel transverse ridges at its upper edge (Fig. 5E–G), representing the free upper margins of the carpels comprising the gynoecium. The groove between the two ridges in each lobe is narrow, or almost completely closed and visible only in fresh specimens with the aid of a lens. Most fimbriae are outgrowths of the inner (adaxial) style ridge (Fig. E–G) nearer the centre of the flower. The outer ridge has fewer and shorter fimbriae or is almost smooth. The fimbriae are branched or unbranched; they vary in colour from pale yellow to dark purple and may be blotched. Anatomically a fimbria comprises an epidermal layer with domed outer cell walls and a narrow core of parenchyma in which a slender vascular strand is embedded. The style arms and stigmas which are below the fimbriae, are of diagnostic value:

In sections *Ferraria* and *Glutinosae* the three style branches are deeply bipartite with slender, sideways spreading, curved arms (Figs 5E, 6A, B), 3.5–5 mm long. The arms taper from ca. 1 mm at their bases to small terminal stigmas.

In section *Macroscyphae* the style branches are flattened and broadened from their bases (Fig. 5F), and 4 to 6 mm in width. They are usually not as deeply cleft as in section *Ferraria*. The shallow groove at the upper transverse edge terminates in a flattened or somewhat concave stigma which is curved outwards and towards the nearest anther lobe.

F. ferrariola is distinguished by its shallowly divided style branches and its flap-like stigmas which are formed by the enlarged outer (abaxial) style ridges only (Figs 5G, 6F). These are strongly recurved and bent outwards over the tops of the anthers, to expose their receptive surfaces. They bear a slight resemblance to the stigmatic flaps of *Moraea*, *Homeria* and *Dietes*.

Capsule The capsules have a thin, crustaceous, straw-coloured pericarp and are generally narrowly ellipsoid but with pointed tip, except in *F. glutinosa* where they vary from shortly ellipsoid to globose. They are mostly 20–40(–50) mm long and ca. 10 mm in diameter, and in *F. glutinosa* up to 15 mm in diameter. This is the only species where the ripe capsules are exserted above the spathes. In the Cape species the capsules become exserted laterally from the withering spathes.

The rostrum is persistent but does not elongate further after anthesis. After dehiscing loculicidally, the rostrum finally also splits into three valves.

The seeds are ca. 3–4 mm in diameter and usually golden-brown and shiny

when ripe. They are angled by pressure and roughly, though sparsely, wrinkled—except in *F. divaricata* subsp. *arenosa* and subsp. *aurea* where they are almost globose and foveolate-reticulate or finely reticulate.

CHROMOSOMES

The only previous report on the chromosomes of *Ferraria* is that of Goldblatt (1971) who examined *F. crispa* (as *F. undulata*), *F. ferrariola* (as *F. longa*) and a plant (ex hort.) named *F. cf. framesii* from the Caledon area, a doubtful identification.

The somatic chromosomes of all ten species of *Ferraria* have now been studied, including geographically distinct populations of seven of the species. This makes *Ferraria* cytologically one of the best known genera of Iridaceae (Figs 7–10).

Method Roots 7–10 mm in length, starting to sprout from corms, were pretreated for 4 hours in a solution of 0.001 M 8-hydroxyquinoline to which a few crystals of maltose had been added, and fixed in acetic-ethanol (1:3). After hydrolysis in N HCl at 60 °C for 9 minutes, they were stained with the Feulgen stain for 4–8 hours and squashed in 45 % acetic acid containing 0.25 % carmine. Some preparations were permanently mounted in euparal.

In order to make immediate use of plants collected from the veld, very young flower buds were sometimes cut up and used instead of root tips. (The latter only become available at the beginning of the following growing season or, when corms remain dormant longer than one summer, two or even three years later.) Although the chromosomes in flower buds are 12–25 % smaller than in root tips, they also give excellent squashes for chromosome examination.

Idiograms were drawn up from three, or rarely only two, metaphase plates of root tips, except where otherwise stated; they therefore do not represent the specific metaphase plates figured.

Observations Six of the Cape species, as well as the central African species *F. glutinosa*, are diploid with $2n = 20$ (Table 1). The basic number for the genus is $x = 10$ and is similar to that of *Dietes* and several subgenera of *Moraea* (Goldblatt 1971, 1976b).

Polyploidy occurs in three species, all three being heteroploid with diploid and tetraploid populations in *F. divaricata*, and tetraploid and hexaploid populations in *F. crispa* and *F. schaeferi*. These polyploids constitute distinct geographical races, and subspecific status has now been given to the races of *F. divaricata* and *F. crispa*, as some slight morphological differences also occur between the races. The tetraploid *F. divaricata* subsp. *australis* has established itself towards the south and south-east away from its diploid ancestors, and the hexaploid race of *F. crispa* has also migrated southwards. See under GEOGRAPHICAL DISTRIBUTION.

The hexaploid form of *F. schaeferi* has migrated northwards and occurs in the coastal area of the southern Namib desert near the type locality of the species. No

TABLE 1.

Chromosome numbers in *Ferraria* species. The localities are given as latitude-longitude squares.

Species	Diploid chromosome number	Herb. No. <i>De Vos</i> (or other)	Locality
Sect. <i>Glutinosae</i>			
<i>F. glutinosa</i>	20	2408	1127 Lubumbashi, Zaïre
Sect. <i>Ferraria</i>			
<i>F. foliosa</i>	20	2396	3017 Hondeklipbaai -DC
	20	2318	3218 Clanwilliam -AD
	20	2365	3218 Clanwilliam -AD
<i>F. crispa</i>			
ssp. <i>nortierii</i>	40	2374	3218 Clanwilliam -AB
	40	2354	3218 Clanwilliam -AD
	40	2375	3218 Clanwilliam -BA
	40	2376	3218 Clanwilliam -BD
	40	2401	3218 Clanwilliam -DC
ssp. <i>crispa</i>	60	2285	3317 Saldanha -BD
	60	2324	3318 Cape Town -BC
	60	2351	3322 Oudtshoorn -BC
	60	75/34	3418 Simonstown -BD
	60	2382	3420 Bredasdorp -CC
	60	2293	3421 Riversdale -BD
	60	Goldblatt (1971)	(Cape Town)
<i>F. schaeferi</i>	60	2379	2615 Lüderitz -CD
	40	2393	2615 Lüderitz -CB
	40	2392	2916 Port Nolloth -BD
	40	2391	2917 Springbok -CA
<i>F. densepunctulata</i>	20	2317	3218 Clanwilliam -AD
Sect. <i>Macroscyphae</i>			
<i>F. ferrariola</i>	20	2300	2917 Springbok -DB
	20	2372	3118 Vanrhynsdorp -AD
	20	<i>Moffett</i> 901	3118 Vanrhynsdorp -CA/B
	20	2294	3218 Clanwilliam -BB
	20	Goldblatt (1971)	(Botterkloof)
<i>F. divaricata</i>			
ssp. <i>divaricata</i>	20	75/16	2822 Glenlyon -AB
	20	2331	2917 Springbok -DA
	20	2386	2917 Springbok -BD
	20	2329b	2917 Springbok -DD
	20	2358	3118 Vanrhynsdorp -DA
	20	2353	3119 Calvinia -CD
	± 20	75/17	3120 Williston -AD
	20	2361	3218 Clanwilliam -BD
	20	2348	3219 Wupperthal -AA
ssp. <i>arenosa</i>	20	2356	3118 Vanrhynsdorp -CA
	20	2387	3118 Vanrhynsdorp -CB
	20	2295	3118 Vanrhynsdorp -DD
	20	76/14	3318 Cape Town -BD
	20	2385	3318 Cape Town -DC
ssp. <i>aurea</i>	20	2384	3118 Vanrhynsdorp -CA
	20	2333	3118 Vanrhynsdorp -DA

Species	Diploid chromosome number	Herb. No. <i>DeVos</i> (or other)	Locality
<i>ssp. australis</i>	20	2297	3218 Clanwilliam -AB
	40	2373	3118 Vanrhynsdorp -CB
	40	2290	3319 Worcester -AC
	40	2335	3319 Worcester -AD
	40	2299	3319 Worcester -DA
	40	<i>Moffett</i> 713	3320 Montagu -BA/B
	± 40		3322 Oudtshoorn -BC
	40	2380	3419 Caledon -AC
<i>ssp. divaricata</i>			
X <i>ssp. australis</i>	30	2389	3118 Vanrhynsdorp -DC
<i>ssp. australis</i>			
X <i>F. crispa</i>	50	2407	3319 Worcester -BD
<i>ssp. australis</i>			
X <i>F. crispa</i> ?	± 60	2405	3420 Bredasdorp -CA
<i>F. kamiesbergensis</i>	20	2399	3017 Hondeklipbaai -BC
	20	<i>Oliver</i> 5970	3018 Kamiesberg -CA
	20		3119 Calvinia -AB
<i>F. uncinata</i>			
<i>ssp. uncinata</i>	20	2359	3218 Clanwilliam -BD
	20	2325	3218 Clanwilliam -DC
<i>ssp. macrochlamys</i>	20	2329a	2917 Springbok -DD
	20	2328	3017 Hondeklipbaai -BB
<i>F. brevifolia</i>	20	2326	3118 Vanrhynsdorp -AB

subspecific name has been given to the tetraploid form of this species, as it does not differ morphologically from the hexaploid.

The size of the chromosomes of the Cape species of *Ferraria* range from 2–6(–7) μm in length with the method used, whereas the relatively primitive *F. glutinosa* from Zaïre has chromosomes 5–11 μm long (cf. Figs 7–10). A phylogenetic reduction in chromosome size has therefore taken place in the genus.

The karyotypes of the Cape species are remarkably similar, the haploid set comprising (Figs 8–10): two large chromosomes, *a*, *b*, almost equal in length with a subterminal centromere in the one and a somewhat less subterminal centromere in the other; three medium-sized chromosomes, *c*–*e*, with subterminal centromeres; two medium to small chromosomes, *f*, *g*, one with an almost completely median centromere and the other with a submedian one; and three small chromosomes, *h*–*j*, with more or less subterminal centromeres.

The two pairs of chromosome sets in the karyotype of the tetraploids, as well as the three sets in the hexaploids, show slight differences in chromosome sizes (Figs 8C–E). This may be an indication of allopolyploid origins.

Satellites are small and easily overlooked. They are mostly located on the short arm of one of the medium sized chromosomes.

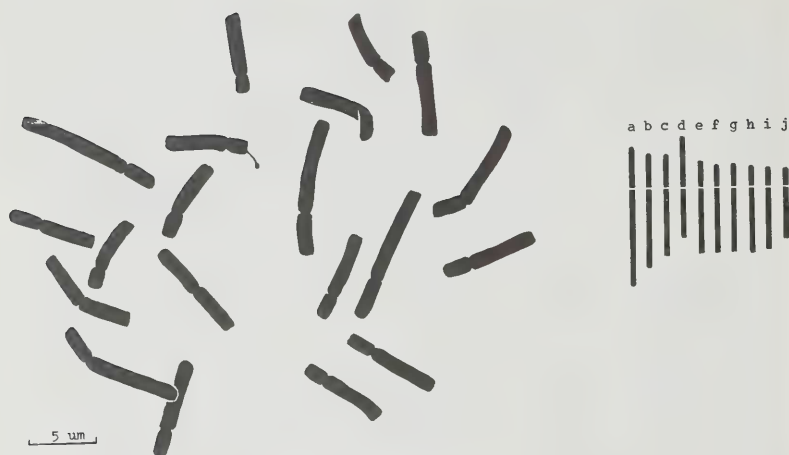


FIG. 7.
Karyotype of *Ferraria glutinosa*.

In addition to their larger size, the chromosomes of the primitive *F. glutinosa* differ in being somewhat less asymmetrical, nine chromosomes of the set possessing submedian centromeres and one, *d*, a median centromere; there is also less difference in the sizes of the chromosomes (Fig. 7), the shortest chromosome being slightly more than half the length of the largest, and the average size of the eight shorter chromosomes being ca. 70 % of that of the longest two (whereas in the Cape species this percentage varies from 50 to 58 %) (Table 2). These observations are in accordance with Stebbins's statement (1950) that a more symmetrical karyotype often coincides with a relatively primitive external morphology.

TABLE 2.

Chromosome symmetry of the diploid *Ferraria* species. A, average length in μm of the two longest chromosomes; B, average length of the other eight chromosomes.

Species	A	B	% $\frac{B}{A}$
<i>F. glutinosa</i>	9,4	6,5	71
<i>F. foliosa</i>	6,2	3,5	57
<i>F. densepunctulata</i>	6,0	3,5	57
<i>F. ferrariola</i>	5,7	3,0	52
<i>F. divaricata</i> (diploid subspecies)	6,2	3,4	55
<i>F. kamiesbergensis</i>	6,3	3,5	55
<i>F. uncinata</i>	6,2	3,6	58
<i>F. brevifolia</i>	6,8	3,4	50



FIG. 8.

Karyotypes of *Ferraria* species, section *Ferraria*. A, *F. foliosa*; B, *F. densepunctulata*; C, *F. crispa* subsp. *nortierii*; D, *F. crispa* subsp. *crispa*; E, *F. schaeferi*.

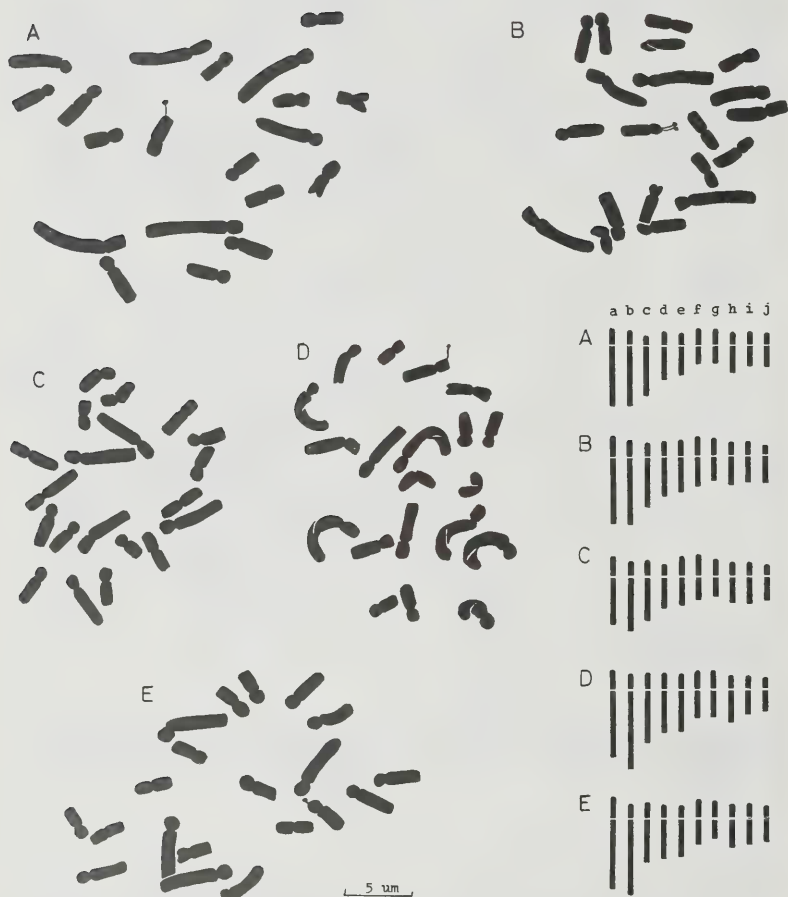


FIG. 9.

Karyotypes of *Ferraria* species, section *Macroscyphae*. A, *F. ferrariola*; B, *F. kamiesbergensis*; C, *F. uncinata* subsp. *uncinata* (with idiogram constructed from one metaphase); D, *F. uncinata* subsp. *macrochlamys*; E, *F. brevifolia*.

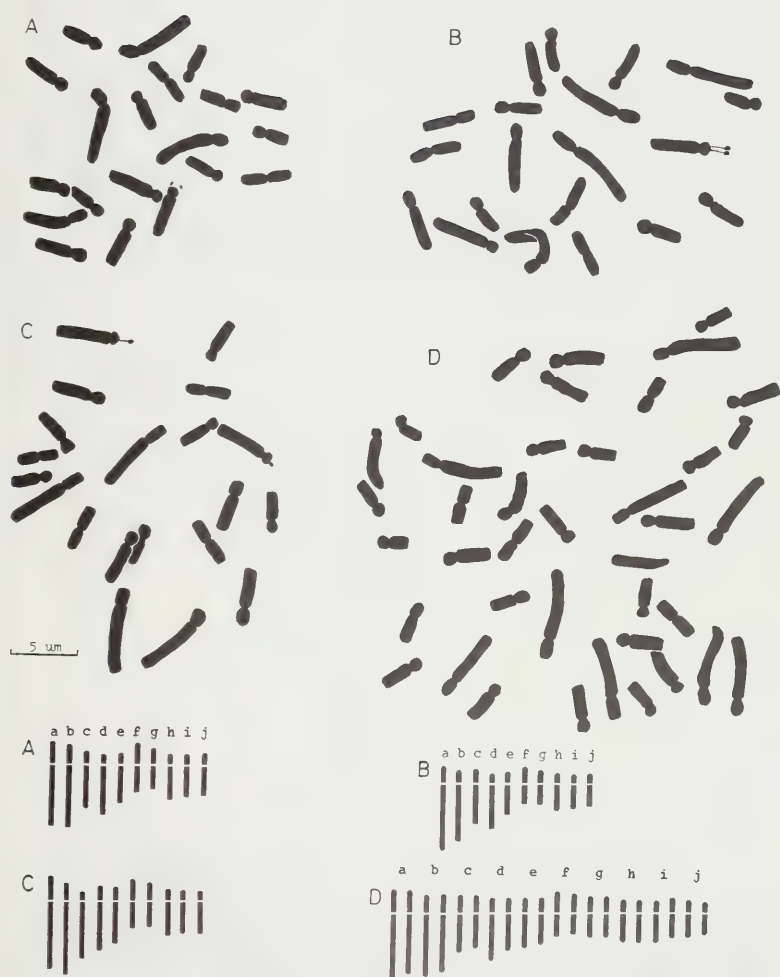


FIG. 10.
Karyotypes of *Ferraria divaricata* (section *Macrosyphae*). A, subsp. *aurea*; B, subsp. *divaricata*; C, subsp. *arenosa*; D, subsp. *australis*.

GEOGRAPHICAL DISTRIBUTION OF THE SPECIES AND NOTES ON THEIR ECOLOGY

Ferrarias are wide-spread in Africa south of the equator, from ca. 6° to the southern tip of Africa at $S\ 34^{\circ} 50'$, and from ca. $E\ 13^{\circ}$ to 31° , i.e. from the west coast to a southern extension of the Rift Valley.

All ten species occur in the Cape Province of the R.S.A. and nine of these grow in the winter rainfall region and are adapted to winter rainfall conditions. Most are concentrated on the western lowlands of the Cape Province below the first escarpment, from sea level to about 300 metres altitude. Two species, *F. foliosa* and *F. densepunctulata*, are local endemics with small ranges on coastal sand within 15 km of the coast (Fig. 11). *F. brevifolia* (Fig. 13B) also has a small range on sandy or gravelly shale somewhat more inland.

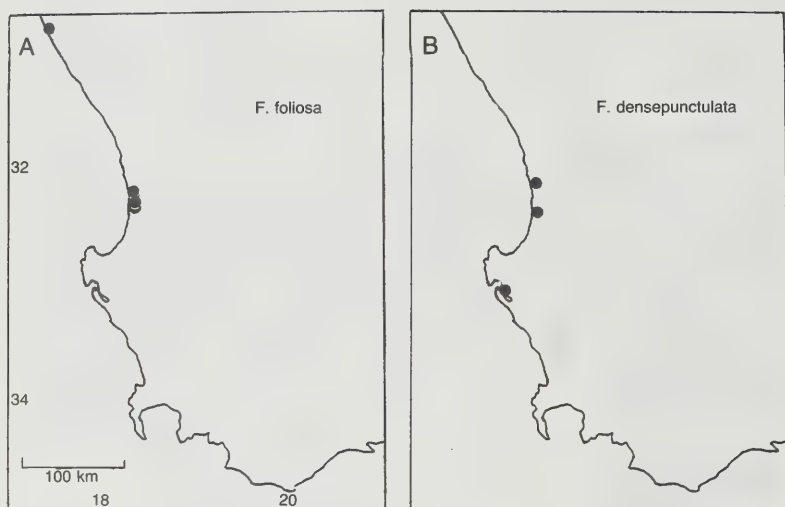


FIG. 11.

Geographical distribution of A, *Ferraria foliosa* and B, *F. densepunctulata*.

The other five species, namely *F. crispa*, *F. ferrariola*, *F. divaricata*, *F. kamiesbergensis* and *F. uncinata*, are more widely distributed (Figs 12–14) and have outliers towards, or on, the adjoining higher inland plateaux. Some of their localities are not typical winter rainfall areas, but the plants have retained their seasonal rhythm of sprouting in autumn, flowering in spring and being dormant during the summer. *F. divaricata*, with its four subspecies, has the widest distribution in the R.S.A., occurring throughout Namaqualand to the south-western Cape region and eastwards to Oudtshoorn (Fig. 14). One of its subspecies has also been found in the Great Karoo near Bristown, Carnarvon and Kenhardt, as well as in the Kalahari north of the Orange River.

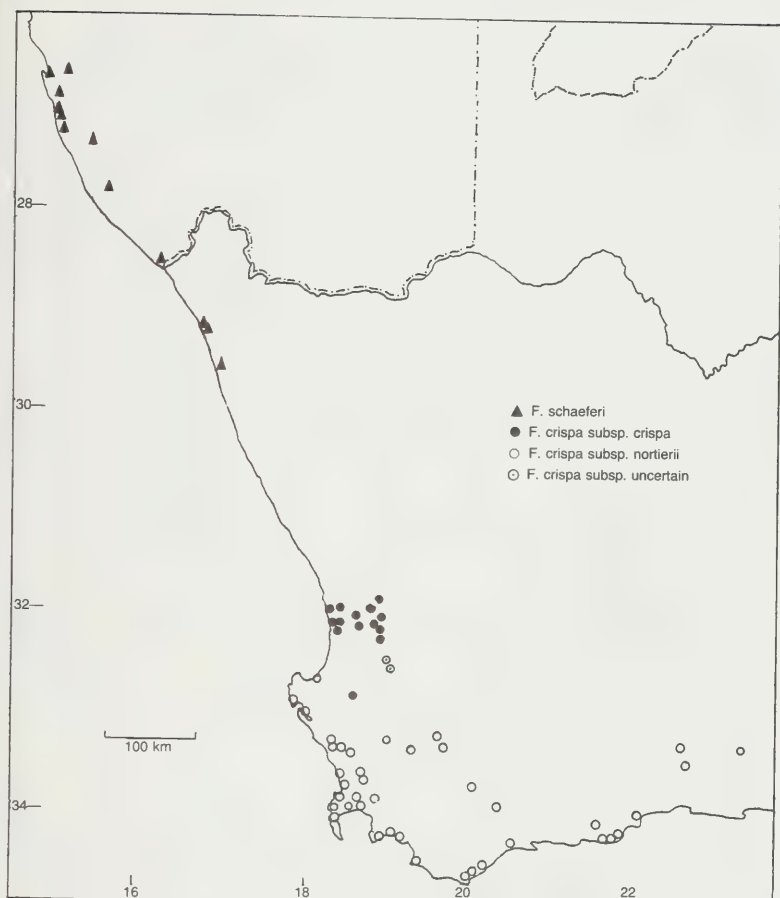


FIG. 12.
Geographical distribution of *Ferraria crispa* and *F. schaeferi*.

The highest concentration of species occurs in the latitude-longitude degree squares of 3218 (Clanwilliam) with six species and 2917, 3017, 3118, i.e. from Springbok southwards to Vanrhynsdorp with five species per square (Fig. 16). Levyns (1964) gave as her opinion that a genus with a maximum concentration of species in the Clanwilliam area or further north, is not part of the Cape Flora but belongs to the Karoo Flora which migrated later than the Cape Flora from the

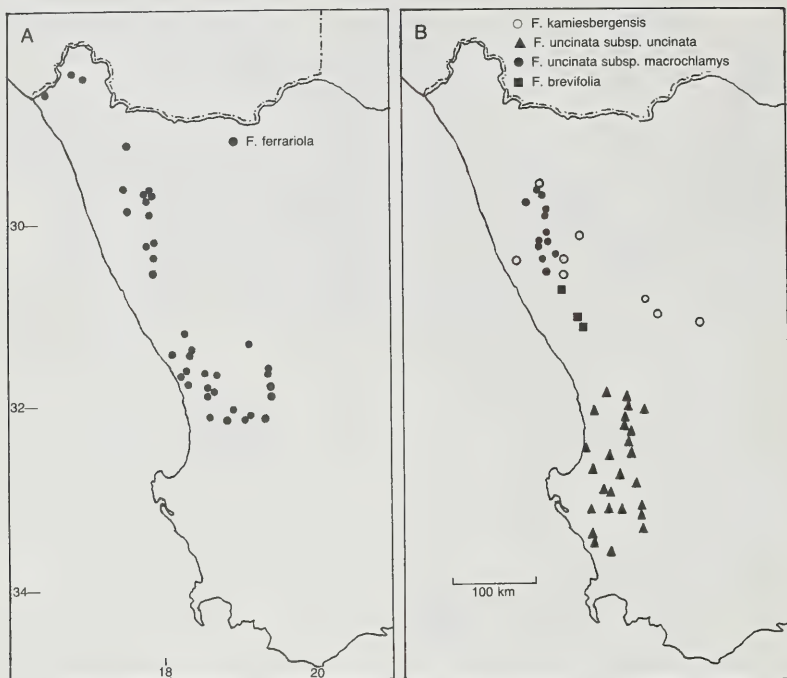


FIG. 13.

Geographical distribution of A, *Ferraria ferrariola*, and B, *F. kamiesbergensis*, *F. uncinata* and *F. brevifolia*.

north. She mentioned *Babiana* as an example. *Ferraria* also belongs in this category.

Most of the species in the above-mentioned degree squares are diploids and this region, from Springbok to Clanwilliam, probably constitutes a centre of development for the genus. In the south-western Cape region and the southern districts only polyploids (*F. divaricata* subsp. *australis* and *F. crispa* subsp. *crispa*) have been found, with a single exception of the diploid *F. divaricata* subsp. *arenosa* which has spread as far south as Bellville near the Cape. The only other polyploid species is *F. schaeferi* which spread northwards into the Namib desert from the above-mentioned developmental centre (Fig. 12).

Only three species occur to the north of the Republic (Figs 12, 14, 15). One, *F. glutinosa*, has the widest distribution of all *Ferraria* species and has been found in Zaïre, Zambia, Rhodesia, Angola, Namibia and Botswana, as well as in the Kalahari (northern Cape Province). This is the only summer-flowering species.

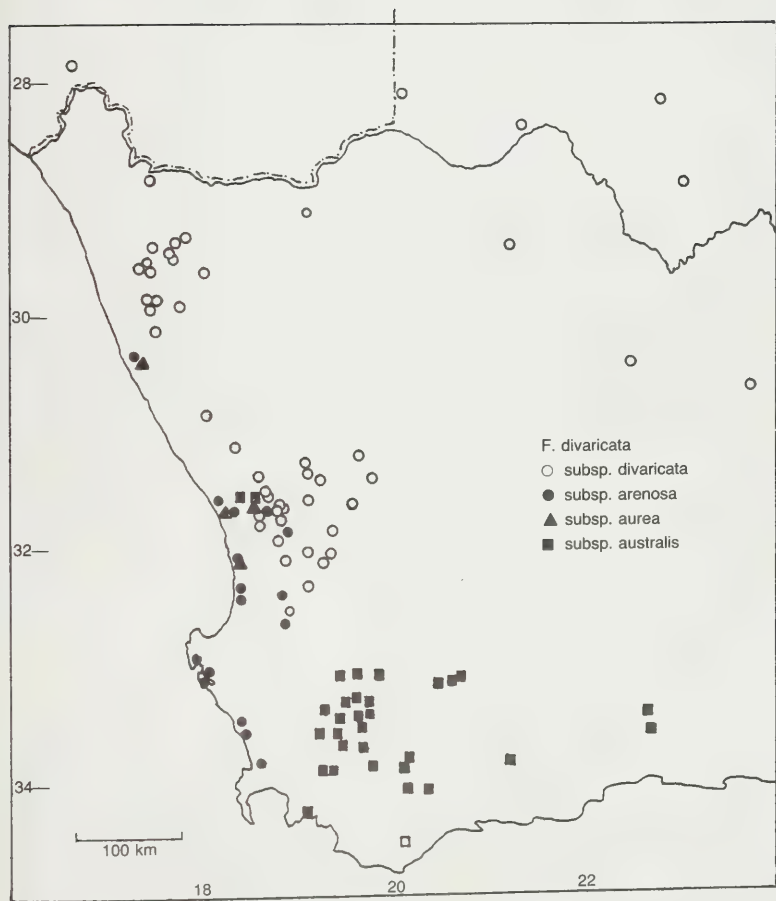


FIG. 14.
Geographical distribution of *Ferraria divaricata*.

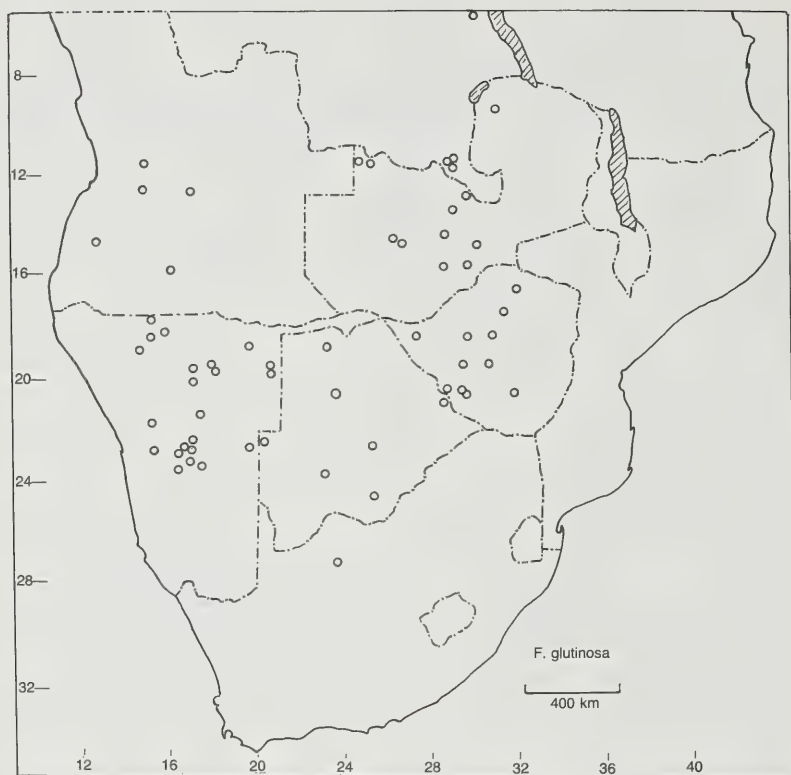


FIG. 15.
Geographical distribution of *Ferraria glutinosa*.

A second, *F. schaeferi*, has a small range in the southern Namib desert within 60 km from the coast, from Lüderitz Bay southwards into Namaqualand. The small amount of rain that falls in the southern Namib desert (less than 100 mm p.a.) occurs mostly in winter and *F. schaeferi* is adapted to winter rainfall conditions. The third, *F. divaricata* subsp. *divaricata* has been found once in southern Namibia.

The majority of *Ferraria* species are adapted to dry habitats. Rainfall maps show less than 100 mm p.a. over the coastal zone from Lüderitz Bay to the mouth of the Groenrivier and for approximately 40 km inland. Here four species occur, namely *F. schaeferi*, *F. foliosa*, *F. ferrariola* and a subspecies of *F. divaricata*. Perhaps the heavy sea mists which drift in from the coast, help these plants to grow and survive.

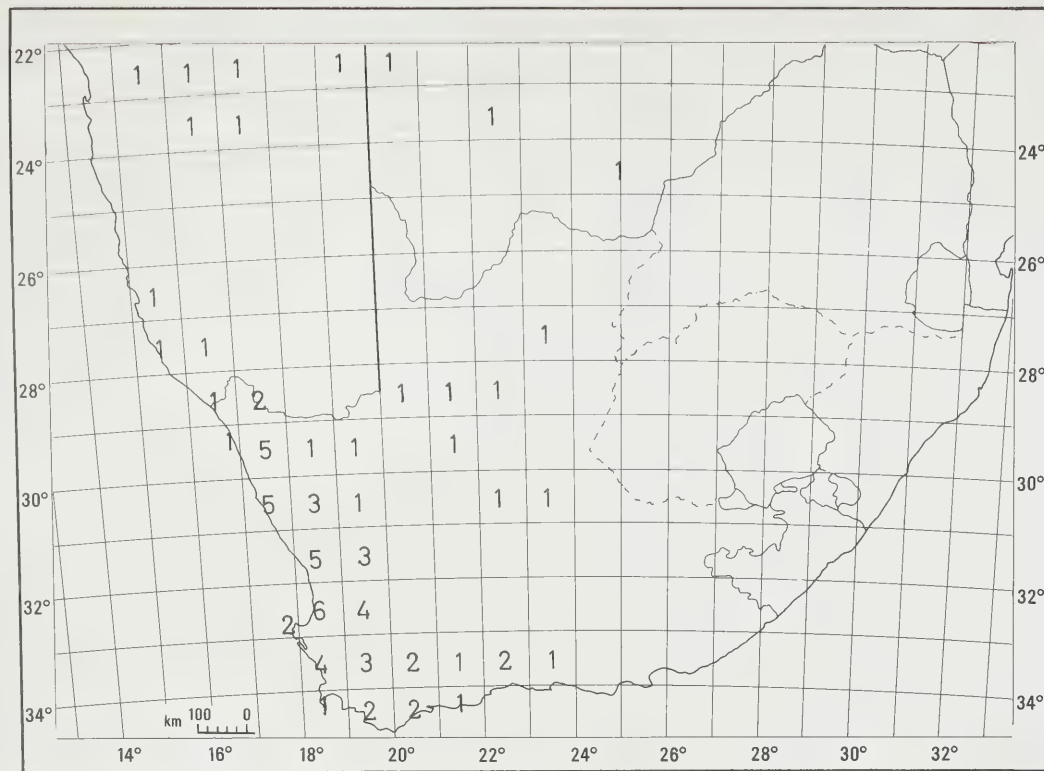


FIG. 16.
Ferraria species concentration in the R.S.A. and southern parts of Namibia and Botswana.

Inland, and adjoining this area, from the Richtersveld to Vanrhynsdorp, and southwards towards the coast near Lamberts Bay, is a wide zone with 100–200 mm of rainfall annually. Here all five species of section *Macroscyphae* have been recorded, as well as three of the four species of section *Ferraria*. South of Lambert's Bay the rainfall increases progressively towards the Cape Peninsula, and the number of species becomes fewer. In the Cape Peninsula only the hexaploid *F. crispa* occurs. (Fig. 12).

Most *Ferraria* species grow in sand; some, e.g. *F. schaeferi*, *F. foliosa*, and *F. densepunctulata* are confined to litoral sand. Other species, e.g. *F. crispa*, *F. ferrariola* and *F. divaricata*, generally grown in sandy soil, shale, or stony ground.

TAXONOMIC HISTORY OF *FERRARIA*

Ferrarias were brought to Europe even before the middle of the seventeenth century and cultivated there as items of interest, on account of their unusual flowers. The first description and illustration of a *Ferraria* was by an Italian, J. B. Ferrari, in his work *Flora seu de florum cultura*, published in Rome in 1633, and in Amsterdam in 1646, under a descriptive title *Flos indicus e violaceo fuscus radice tuberosa*.

Three more pre-Linnaean authors described and figured a *Ferraria* under descriptive titles: Morison (1680) named his plant *Gladiolus indicus e violaceo fuscus*; Rudbeck (1701) *Narcissus indicus flore saturate purpureo*; and Barrelier (1714) *Iris stellata cyclamine radice pullo flore*.

During the next two centuries Ferrarias were illustrated in works by Miller (1759a), Burman (1761), Jacquin (1770, 1804), Curtis (1791), Andrews (1803), Redouté (1803) and Sweet (1826, 1827).

The name *Ferraria* was first used in 1759 by two workers, namely Miller and Wännman. Miller, in his description, ascribed the name to Johannes Burman whose detailed description of the genus and of two species bears the date October 1758 but only appeared in 1761 in an obscure publication. It can therefore be deduced that Miller saw this description before its publication. (The two species described and figured by Burman are *F. crispa* and *F. fimbriata*. The latter, however, cannot be identified on account of its incorrectly drawn androecium and stigmas and an inadequate description of the flower; it is now excluded.)

In a work dated May 30, 1759, often ascribed to Wännman, but written by Linnaeus himself, mention is made of the genus in the following words (p. 361): "Nec minus singulares sunt *Ferraria* petalis undulatis", and on p. 370 *F. undata* (an orthographical error for *F. undulata*) is given, a nomen nudum.

Miller's figure (t.280) bears the date January 26, 1759. According to Stafleu (1967, p. 315) the dates on Miller's plates, though not necessarily the dates of publication, are probably very near this. If so, Miller's description of the genus,

which he ascribed to Burman, antedates that of Wännman. But in any case, the latter's two (or three) worded diagnosis cannot be regarded as a valid publication.

Linnaeus therefore erred in the second edition of the *Species Plantarum* (1763) when he used his own epithet *undulata*. He cited Burman's work of 1761 but overlooked Burman's epithet *crispa*, and made out that Burman had given the species only a descriptive title, *foliis nervosis*. As Linnaeus cited Burman's species in his circumscription of *F. undulata*, this name is superfluous and illegitimate; Moore (1974) already drew attention to this fact.

On account of the obscurity of Burman's publication, the genus has generally been ascribed to Linnaeus, notwithstanding the fact that Linnaeus again cited Burman as author of the name *Ferraria* in the sixth edition of the *Genera Plantarum* (1764). The only workers who acknowledged Burman were Sprengel (1830), Harvey (1838) in the first edition of his *Genera of South African Plants* (but not in the second edition of 1868), and Moore (1974).

The younger Linnaeus (1781) described an American species as *F. pavonia*, thereby broadening the circumscription of the genus. In the course of years numerous extra-African, and African, species were placed under *Ferraria*, Salisbury (1796), for example, recognised twelve *Ferraria* species, only one of which, *F. undulata*, is a true *Ferraria* by modern standards. Eleven of Salisbury's species were finally transferred to six different genera.

During the eighteenth century only one other true species of *Ferraria* was described, as *Moraea ferrariola* Jacq. In the nineteenth century Sweet (1826–27) described *F. obtusifolia*, *F. divaricata* and *F. uncinata*, and Ker (1804) described *F. antherosa*. Unfortunately Ker confused two species, citing as a synonym *F. viridis* which is an orthographic error for *F. viridiflora*, a different species described by Andrews (1803). As he cited as a synonym, his epithet is superfluous and therefore illegitimate and must be replaced by Sweet's epithet *divaricata* for this species. Most workers of the nineteenth century followed Ker in equating *F. antherosa* and *F. viridiflora*.

Klatt (1865–66) also caused confusion by recognising only three species, namely *F. obtusifolia*, *F. divaricata* and *F. undulata* and by citing five synonyms for the last mentioned species, none of which is *F. undulata*. He corrected this error in 1882 to some extent when he recognised three of these synonyms as distinct species.

Baker (1877, 1892, 1896) recognised six South African *Ferraria* species and in 1898 in the *Flora of Tropical Africa* another two species, namely *F. welwitschia* and *F. bechuanica*, from Angola and Bechuanaland respectively; he further described several tropical species of *Ferraria* under *Moraea*; these were later transferred to *Ferraria*. All these species described in 1898 were based on trivial differences such as flower colour, leaf width and plant size. Their types show that they are variations of a single species, *F. glutinosa*. Baker did not have enough material to recognise the differences as continuous variations.

During the twentieth century a further eight African species of *Ferraria* were described. Of these only three species, namely *F. schaeferi* Dinter, *F. foliosa* Lewis and *F. brevifolia* Lewis can be retained, the rest being synonyms of already described species.

ORIGIN AND RELATIONSHIPS OF *FERRARIA*

Ferraria belongs to the subfamily Iridoideae, tribe Irideae. Several workers considered the genus to stand closer to *Homeria*, *Hexaglottis* and *Tigridia* than to *Moraea*: Bentham and Hooker (1883) for example, placed *Ferraria* near *Homeria* and *Tigridia* in a group of species distinguished by connate filaments and bifid style branches which were a little shorter, or hardly longer, than the anthers. Pax (1888) placed *Ferraria* in his tribe *Tigridieae* subtribe *Cipurinae*, together with *Homeria* and *Hexaglottis*, while *Tigridia* went into subtribe *Tigridinae*. He placed *Moraea* together with *Iris* in another tribe *Moraeae* subtribe *Iridinae*. Diels (1930) did not distinguish subtribes, placing the above-mentioned genera, as well as *Dietes*, in one tribe, *Moraeae*.

Lewis (1954) followed Pax more or less, in recognising his subtribes *Cipurinae* (in which she also included *Galaxia*) and *Iridinae*, the latter comprising *Moraea*, *Dietes*, *Iris* and *Gynandriris*.

Goldblatt (1971), taking the karyotypes of the genera into consideration, split the subtribe *Cipurinae* into two, placing *Ferraria* as only genus in subtribe *Ferrariinae* and the genera *Homeria*, *Hexaglottis* and *Galaxia* in subtribe *Homeriinae*. He distinguished subtribe *Ferrariinae* from the *Homeriinae* in chromosome number, style with dissected feathery apex, in perianth segments, and corms almost naked. He regarded *Ferraria* as "a derivative of South African *Irideae* which diverged early from the line leading to *Moraea*, but after the single internode of the group corm had been evolved". Later (1976c) he came to the conclusion that *Moraea* and *Gynandriris* are allied to *Homeria* and transferred these genera from subtribe *Iridinae* to *Homeriinae*; but he kept *Dietes* in *Iridinae*.

To my mind also, there is sufficient reason for placing the genus *Ferraria* in a distinct subtribe. It is related to *Dietes* and *Moraea*, and probably originated (like *Moraea*, v. Goldblatt, 1976b), from a *Dietes*-like ancestor in central Africa south of the equator, where its most primitive species, *F. glutinosa*, still occupies a wide area. *Ferraria*, with a corm often comprising more than one internode, possibly diverged from the common stock which possessed a rhizome, before the single internode corm and the bifacial leaf of *Moraea* had evolved. Migration of *Ferraria* then took place to the western Cape region of the R.S.A. where the present developmental centre occurs. The basic chromosome number is $x = 10$ for *Dietes* and the primitive species of *Moraea* (Goldblatt, 1976b), as well as for *Ferraria*.

Probably the relationship of *Ferraria* with the new world genus *Tigridia* is not close. Molseed (1970) who monographed *Tigridia*, did not comment on this

aspect, except to mention that the data which the younger Linnaeus had, when he placed a *Tigridia* species with *Ferraria*, were inadequate. Goldblatt (1971) mentions that there is only a superficial resemblance between the flowers of the two genera. In truth, *Tigridia* differs in the possession of a bulb, spathes enclosing a condensed raceme, perianth segments without crisped margins, filaments entirely connate, and crestless style branches, as well as in chromosome number.

The only division of *Ferraria* into subgeneric species groups is by Baker (1877) who divided the genus into two groups, namely *Macroscyphae* comprising species with divaricate anther lobes, and *Brachyscyphae* with parallel anther lobes. As the latter includes the type species of the genus, this name is untenable for a section of the genus. The name *Macroscyphae* is, however, retained for one of the sections.

TAXONOMY

Ferraria Burm. ex Mill., Ic.: 187 (1759) & Gard. Dict. ed. 7 addenda (1759) & ed. 8 (1768); Burm., Nova Acta Acad. Caes. Leop.-Car. 2: 198 (1761); L., Sp. Pl. ed. 2, 2: 1353 (1763) & Gen. Pl. ed. 6,: 465 (1764) & Syst. Nat. ed. 13,: 597 (1770); Ker, in Kon. & Sims, Ann. Bot. 1: 241 (1805) & Irid. Gen.: 27 (1827); Roem. & Schult., Syst. Veg. 1: 345 (1817) pro parte; Spreng., Gen. Pl.: 527 (1830); Endl., Gen. Pl. 3: 166 (1837); Harv., Gen. S. Afr. Pl.: 334 (1838) & ed. 2: 372 (1868); Klatt, in Linnaea 34: 624 (1865-66); Bak., in J. Linn. Soc. Bot. 16: 105 (1877) & Hdb. Irid.: 72 (1892) & Fl. Cap. 6: 29 (1896); Benth. & Hook. f., Gen. Pl. 3: 692 (1883); Pax, in Nat. Pflanzenfam. 2(5): 148 (1888); Diels, in Nat. Pflanzenfam. ed. 2, 15a: 496 (1930); Lewis, in Adams. & Salter, Fl. Cape Penins.: 224 (1950); Phillips, Gen. S. Afr. Flow. Pl. ed. 2: 214 (1951) pro parte; Solch & Roessl. in Merxm., Prodr. Fl. SWA. 155: 3 (1969); Goldblatt, in Jl S. Afr. Bot. 37: 438 (1971) & in Dyer, Gen. S. Afr. Flow. Pl.: 967 (1976). *Moraea* pro parte, Thunb., Diss. *Moraea*: (1787).

Plants small to medium sized, deciduous geophytes. *Underground stem* a group of persisting corms to which a new corm is added annually; corms hard, variously shaped, with tunics largely evanescent. *Aerial stem* erect, covered with leaf sheaths or rarely with partly bare internodes, branched in the upper portion, branches short. *Cataphylls* 1-3, sheathing the base of the shoot. *Foliage leaves* few to numerous, cauline, firm, glabrous, often glaucous, distichous or sometimes spirodistichous, equitant, suberect or spreading, with bifacial, sheathing leaf base and unifacial, ensiform to linear or rarely scimitar-shaped blade, upper leaves shorter and somewhat bract-like. *Cymes* few to numerous, terminal on main and lateral branches, 2-flowered or rarely with up to 6 flowers (*F. glutinosa*), enclosed in two large, erect, herbaceous spathes. *Pedicels* hidden by the spathes. *Flowers* actinomorphic, remaining open for 1-3 days. *Perigone segments* free, unguiculate, with suberect claws forming a cup, and with limbs spreading, soon reflexed, variously coloured, spotted and blotched with mostly dull colours, the limb

margins crisped, often discolourous, tips acute or acuminate, the outer segments slightly larger than the inner. *Filaments* united into a column around the style, with the upper 1–4 mm free and spreading; *anthers* appressed to the style branches, versatile, thecae parallel or divaricate from their bases, pollen yellow to orange. *Ovary* long, slender, often somewhat triquetrous, with numerous ovules, often tapering into a long, filiform rostrum at the top, rarely shortly club-shaped or ellipsoid (*F. glutinosa*); *style* erect, filiform, 3-branched above the filament tube, the branches short, cleft into two tapering diverging arms or into two broad flattened lobes below densely fimbriate crests; *stigmas* 6, below the fimbriae, minute and terminal on the tapering style arms, or somewhat flattened and marginal on the flat style lobes. *Capsules* ellipsoid with pointed tip, often crowned with a persistent rostrum, or rarely globose; *seeds* numerous, isodiametric, angled by pressure, wrinkled or sometimes reticulate-foveolate, brown to straw-coloured. Chromosome numbers $2n = 20, 40, 60$.

Type species: F. crispa Burm.

KEY TO THE SECTIONS

- 1 Stem partly naked, with gummy areas 10–30 mm long below each cyme; ovary less than 10 mm long. I. Section **Glutinosae**
- 1 Stem usually covered with leaf sheaths, rarely partly naked, but without gummy areas; ovary more than 10 mm long.
 - 2 Anthers with parallel thecae; ovary without a rostrum or rarely with a rostrum up to 8 mm long. II. Section **Ferraria**
 - 2 Anthers with divaricate thecae; ovary with a rostrum more than 10 mm long. III. Section **Macroscyphae**

KEY TO THE SPECIES

- 1 Stem with gummy areas below each cyme; ovary less than 10 mm long, erostrate. 1. **F. glutinosa**
- 1 Stem without gummy areas; ovary more than 10 mm long, rostrate or erostrate.
 - 2 Anthers with parallel thecae.
 - 3 Leaves ensiform or scimitar-shaped, blades more than 5 mm wide; stem stout, usually covered with leaf sheaths. 3. **F. crispa**
 - 4 Lower leaves with a distinctly thickened zone in the middle and a strong (pseudo) midrib, distichous, suberect or sometimes spreading. 3. **F. crispa**
 - 4 Lower leaves with numerous veins about equal in size, often spirodistichous, spreading or recurved.
 - 5 Perianth segments 32–35 mm long, limbs maroon or dark purple with yellow-brown or brownish green margins; style branches with acuminate arms; south of Hondeklipbaai (30 ° S lat.). 2. **F. foliosa**
 - 5 Perianth segments 22–25(–30) mm long, limbs yellow with dark brown spots, blotches and margins; style branches with truncate arms; north of Hondeklipbaai. 4. **F. schaeferi**
 - 3 Leaves linear, blades of lower leaves up to 5 mm wide; stem slender with partly naked internodes.
 - 6 Base of shoot often with reddish purple leaf sheaths, but not spotted; outer perianth segments densely and minutely spotted; style branches with slender, acuminate arms and small terminal stigmas. 5. **F. densepunctulata**
 - 6 Base of shoot usually with reddish purple spotted and blotched leaf

- sheaths; outer perianth segments striate with short lines; style branches and stigmas flattened. 6. *F. ferrariola*
- 2 Anthers with divaricate thecae. 6. *F. ferrariola*
- 7 Foliage leaves short with short obliquely ovate blades which are shorter than the sheaths. 10. *F. brevifolia*
- 7 Foliage leaves or at least the lower ones, with linear to ensiform blades which are longer than the sheaths. 9. *F. uncinata*
- 8 Margins of at least some of the foliage leaves crisped. 9. *F. uncinata*
- 8 Margins of leaves smooth. 9. *F. uncinata*
- 9 Stem partly bare with the lower foliage leaves 1–5 mm wide; base of shoot with reddish purple spotted and blotched leaf sheaths; outer perianth segments striate with short lines. 6. *F. ferrariola*
- 9 Stem usually densely foliose with the leaves usually more than 5 mm wide; base of shoot not spotted or blotched; outer perianth segments without dark lines, but sometimes spotted or blotched. 7. *F. divaricata*
- 10 Outer perianth segments 10–20 mm wide; flowers yellow-green, bluish green, orange to brown, or rarely golden yellow, with a wide bell-shaped perianth cup 13–20 mm diam. at the rim. 7. *F. divaricata*
- 10 Outer perianth segments less than 10 mm wide; flowers pale yellow with a narrow funnel shaped perianth cup 6–10 mm diam. at the rim. 8. *F. kamiesbergensis*

I SECTION GLUTINOSAE De Vos, sect. nov.

Type species: F. glutinosa (Bak.) Rendle.

Caulis magnopere nudus, sub cymis glutinosus; *cymae* ad 6 flores habentes; *ovarium* minus quam 10 mm longum, erostratum; *stylus* et *stigmata* ut in sectione *Ferraria*; *capsula* globosa vel breviter ellipsoidea. *Chromosomatum numerus* $2n = 20$.

This section, comprising one species, stands near section *Ferraria*, corresponding in its anthers with parallel thecae and in the shape of the style branches, stigmas and perianth cup. Its leaf anatomy also indicates a closer relationship with section *Ferraria* than with section *Macroscyphae*, in the sclerenchyma of the larger veins lying against the epidermis, in the absence of epidermal papillae and in the possession of two large veins which form a pseudo-midrib. The fine, homobrochate pollen sculpture, however, resembles that of section *Macroscyphae*.

It differs from the other two sections of the genus in the smaller amount of water storing tissue in the leaves, in its summer flowering habit, its largely naked, laxly branched stem with viscid areas below the cymes in which up to six flowers develop, and in its short ovary and globose or shortly ellipsoid capsule.

1. *Ferraria glutinosa* (Bak.) Rendle, Cat. Welw. Afr. Pl. 2: 27 (1899); Carter in Kew Bull. 17: 317 (1963); Sölch & Roessl., in Merxm., Prodr. Fl. SWA. 155:4 (1969); Goldblatt, in Ann. Mo. Bot. Gdn. 64: 294 (1977).

Moraea glutinosa Bak., in Fl. Trop. Afr. 7: 271, basionym. *Type*: Angola, Huilla near Lopollo, Welwitsch 1543 (BM, holo; K, P, LISU, iso)—& Hdb. Irid.

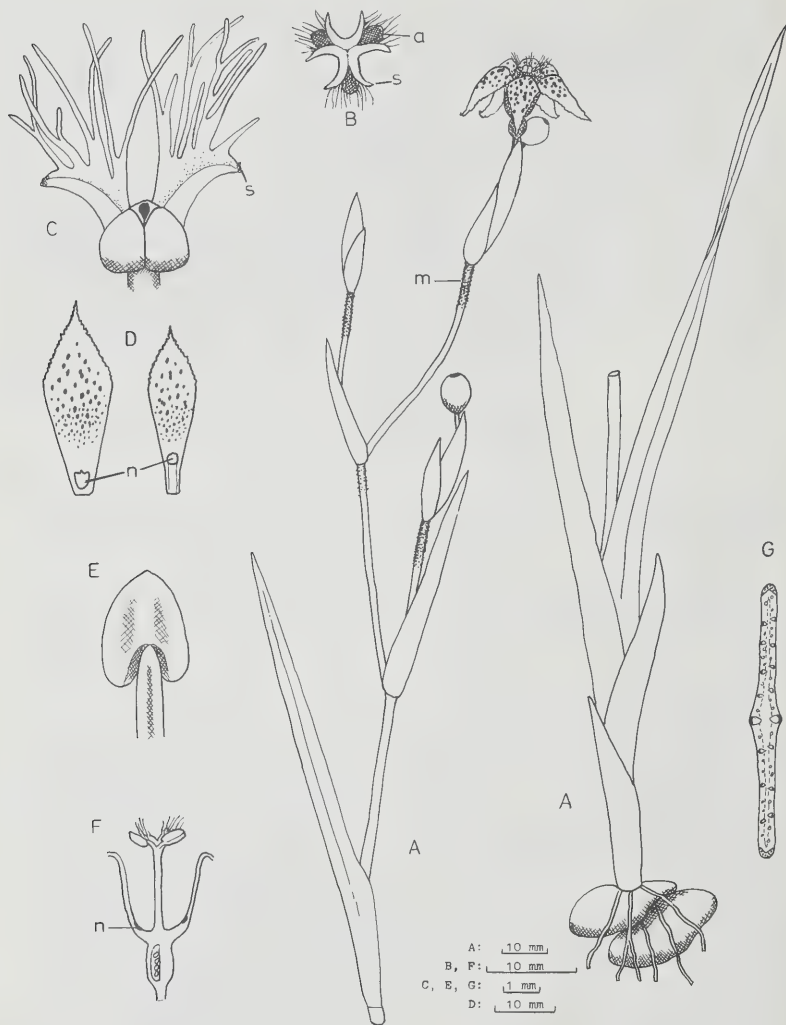


FIG. 17.

Ferraria glutinosa. A, plant; B, style branches and anthers as seen from above; C, one style branch and anther, lateral view; D, outer (left) and inner (right) perianth segments; E, stamens above filament tube, adaxial view; F, longitudinal view of perianth claws, pistil and stamens; G, transverse section of leaf blade; a, anther; m, gummy area with adhering sand grains; n, nectaries; s, stigma.

55 (1892) & Fl. Trop. Afr. 7: 342 (1898); Klatt, in Abh. Naturf. Ges. Halle 15: 367 (1882) & in Dur. & Schinz, Consp. Fl. Afr. 5: 150 (1895).

M. spithamaea Bak., in Trans. Linn. Soc. ser. 2, Bot. 1: 271 (1878). *Type*: Angola, Huilla, around Lopollo & Humpata, *Welwitsch 1547* (BM, lecto; K, iso); & Hdb. Irid.: 55 (1892) & in Fl. Trop. Afr. 7: 341 (1898); Carter, in Kew Bull. 17: 317 (1963) pro syn.; Sölch & Roessl., in Merxm., Prodr. Fl. SWA. 155: 4 (1969) pro syn.

M. candelabrum Bak., in Trans. Linn. Soc. ser. 2, Bot. 1: 271 (1878). *Type*: Angola, Huilla, Morro de Lopollo, *Welwitsch 1544* (BM, lecto; K, LISU, iso); & Hdb. Irid.: 54 (1892) & in Fl. Trop. Afr. 7: 342 (1898); Engl., Hochgebirgsfl. trop. Afr.: 173 (1892).

Ferraria candelabrum (Bak.) Rendle, Cat. Welw. Afr. Pl. 2: 27 (1899).

Moraea andongensis Bak., in Trans. Linn. Soc. Ser. 2, Bot. 1: 271 (1878) pro parte. *Type*: Angola, Pungo Andongo, *Welwitsch 1532* (BM, lecto; K pro parte, LISU, iso); Goldblatt, in Ann. Mo. Bot. Gdn. 64: 294 (1977) pro syn.

Ferraria andongensis (Bak.) Rendle, Cat. Welw. Afr. Pl. 2: 27 (1899); Goldblatt, 1977 l.c. pro syn.

F. welwitschii Bak., Hdb. Irid.: 74 (1892). *Iconotype*: unpublished (K); & in Fl. Trop. Afr. 7: 344 (1898); Rendle, Cat. Welw. Afr. Pl. 2: 27 (1899); Carter, in Kew Bull. 17: 317 (1963) pro syn.; Sölch & Roessl., in Merxm., Prodr. Fl. SWA. 155: 4 (1969) pro syn.

F. bechuanica Bak., in Fl. Trop. Afr. 7: 344 (1898). *Type*: Ngamiland, Kalahari Desert, near Mamumwe, *Lugard 237* (K, holo); Brown, in Kew Bull. 1909: 142; Carter, in Kew Bull. 17: 317 (1963) pro syn.; Sölch, Diss. München: 127 (1961); Sölch & Roessl., in Merx. Prodr. Fl. SWA. 155: 4 (1969) pro syn.

Moraea randii Rendle, in J. Bot. Lond. 36: 144 (1898). *Type*: Rhodesia, Bulawayo, *Rand 233*, Jan. 1898 (BM, holo.; BR, iso.).

Ferraria randii (Rendl.) Rendle, in J. Bot. Lond. 43: 54 (1905).

Moraea aurantiaca Bak., in Fl. Trop. Afr. 7: 575 (1898). *Type*: Angola, Malange, *Von Mechow 303* (B, not seen; drawing of holotype in K); Goldblatt, in Ann. Mo. Bot. Gdn. 64: 294 (1977) pro syn.

M. kitambensis Bak., in Fl. Trop. Afr. 7: 575 (1898). *Type*: Angola, Bangala, *Buchner 679* (B, not seen, K); Goldblatt, 1977 l.c. pro syn.

F. viscaria Schinz, in Mem. Herb. Boiss. 10: 77 (1900). *Type*: Namibia, Omupanda, *Wulfhorst 45* (Z, holo); Sölch, Diss. München: 127 (1961); Sölch & Roessl., in Merxm. Prodr. Fl. SWA. 155: 4 (1969) pro syn.

M. malangensis Bak., in Bull. Herb. Boiss. ser. 2, 1: 862 (1901). *Type*: Angola, Malange, *Von Mechow 386* (B, holo, not seen); Goldblatt 1977 l.c. pro syn.

F. hirschbergii L. Bol., in S. Afr. Gard. 22: 57 & 59 (1932). *Type*: Belgian Congo, near Elizabethville, *Von Hirschberg NBG 615/29* (BOL, holo; K, iso); Carter, in Kew Bull. 17: 317 (1963) pro syn.

Icons: An unpublished figure, as *F. welwitschii*, in K, made for the Regium; two unpublished figures by G. J. Lewis in BOL; this work Figs 17, 15.

Plants (200–)400–700(–900) mm tall. *Corm* depressed globose or irregular, 10–40 mm diam., often comprising several internodes, brown or dark brown. *Stem* (200–)400–700(900) mm long, laxly and often repeatedly branched, with long, largely naked internodes and sticky areas 10–25 mm long below the cymes and many upper nodes. *Cataphylls* 1–3, 50–120 mm long, sheathing. *Foliage leaves* several, 50–200(–600) mm long, shorter towards the top and sometimes also the base of the stem, 4–8 mm wide, linear to narrowly lanceolate, tapering gradually to an acuminate tip, often consisting almost entirely of a bifacial sheath, or the lower ones with a short, or rarely long, unifacial blade, thin in texture, with a stronger median vein. *Cymes* several, solitary at the ends of elongated naked branches, with 2–6 flowers per cyme. *Spathes* not keeled; outer spathe 15–25 (–30) mm long, with narrow, pale or reddish membranous margins, obtuse to acute; inner 30–45(–50) mm long, with membranous margins and a tip which often becomes lacerated later. *Flowers* 30–40 mm long, exserted, almost odourless, brown, maroon or deep purple often spotted and mottled with yellow and with yellow or greenish-yellow narrow margins, or cream or yellow with brown or purple spots and blotches. *Perianth cup* widely bell-shaped, ca. 10 mm deep, 15 mm diam. at the rim, with slits between the claws; nectaries bilobed or entire, 2–5 mm above the claw bases, on the inner claws often slightly higher than on the outer; *segments* horizontal or recurved, with finely crisped margins and acute or acuminate tips; outer segments 28–35 × 8–13 mm with wide claws, inner 25–28 × 5–9 mm, with narrow claws. *Filament tube* 8–10 mm long, the free upper portions 2–3 mm long; *anthers* 5 mm long at first, later 2.5 mm, with parallel thecae and orange or yellow pollen. *Ovary* 5–7 mm long, club-shaped or ellipsoid, not rostrate; *style* ca. 10 mm long, with branches 4 mm long, as in *F. crispa*; *stigmas* terminal. *Capsules* usually 1–2 from a cyme, globose or shortly ellipsoid or obovoid, 12–20(–25) × 10–15 mm, exserted from the spathes; *seeds* shiny brown, up to 5 mm diam., with an irregularly wrinkled testa.

Chromosome number: $2n = 20$.

Flowering period: (October–) November–February (–May).

Distribution: This species has the widest distribution of all *Ferrarias*, occurring in central African countries south of the equator and west of an extension of the Rift Valley, and extending to the Kalahari of the Cape Province and the middle of Namibia. It has, strangely, not been found in Malawi and Transvaal.

ZAÏRE—0528: Niemba (–CC), *De Saeger s.n.* 8.10.34 (BR).

—1127: Lubumbashi area, *Boussard* sub *De Vos* 2408 (STE), *Quarré* 3633 (K); Haut Katanga, environs de Lubumbashi, *Lisowski* 108 (K, BR); Elizabethville, *Von Hirschberg* NBG 618/29 (BOL, SAM); 9 Km ou NE de Lubumbashi, *Bulaimu* 361 (BR); 28 Km ou NE de Lubumbashi, *Malaisse* 7402 (BR); Dambo

Mukuen, *Detilleux* 158 (BR); Keyberg, 8 km SO d'Elizabethville, *Schmitz* 215 (BR).

ANGOLA—1115: Cuanza Sul, Cela-Cassamba, *Teixeira & All* 7396 (LISC).

—1215: Huambo, Nova Lisboa, *Da Silva* 3340 (K, PRE, BR); Chipie, *Stopp* 122 (K);

—1217: Cuemba, Margens do rio Semena, Camacupa, *Teixeira & M.M.* 8683 (LISC).

—1413: Huila, Lubango, Hoque na picada para Dinde, ao km 5—, *De Menezes* 340 (K, PRE, SRGH); Near Lopollo, *Welwitsch* 1567 & 1543 (K); Morro de Lopollo, Huilla, *Welwitsch* 1544 (K).

—1516: Cuene, Cuvelai, *Menezes* 4270 (SRGH).

ZAMBIA—0929: Kawambwa Distr. Luapula Leper Settlement, *Richards* 15485 (K, SRGH).

—1123: Kitwe, *Mutumushi* 2376 & 2843 (K), *Fanshawe* 5314 (K), & 7166 (K, SRGH).

—1124: Mwinilunga, Kalenda Ridge, *Milne-Redhead* 2664 (K, BR); Kabompo Gorge, *Richards* 17475 (K); Woodland below Matonchi, *Richards* 17278 (K, SRGH); Near Mujileshi River, *Richards* 16902 (K, SRGH).

—1228: Mufulira, *Cruse* 92 & 221 (K).

—1327: Chingola, *Linley* 218 (PRE, SRGH).

—1425: Mankoya, about 30 mls W of Kafue Hook pontoon, *Drummond & Cookson* 6734 (PRE, K, SRGH); Kafue Nat. Park, *Lawton* 1178 (K).

—1427: Mumbwa, *Macaulay* 993 (K).

—1527: Mazabuka, Ridgeway Road, *C.R.S.* 541 (PRE, K).

—1528: Lusaka, Vallée de Lufuko, *Quarré* 7505 (BR).

RHODESIA—1630 (Mazoe): Umvukwes (-DD), *Wild* 3911 (PRE, K, SRGH).

—1826 (Wankie): Ngano Pass, Gwaai Reserve, *Paterson* 8 (SRGH).

—1828 (Gokwe): Charama rd., *Bingham* 393 (PRE, SRGH); Sergwa Res. Sta., *Jacobsen* 404 (SRGH).

—1829 (Queque): Mlezu School Farm 18 mls SSE of Queque, *Biegel* 720 (K, SRGH).

—1928 (Nyamandhlovu): Bongola Farm, *West* 3064 (SRGH).

—1929 (Gwelo): Gwelo (-DB), *Holland NBG* 92/28 (BOL, K).

—2027 (Plumtree): Plumtree (-BD/DB) *Eyles Hb.* 8543 (K, BR), *Brain* 10919 (SRGH).

—2028 (Bulawayo): Bulawayo (-CA), *Brain* 5056 (SRGH), *Norman* R44 (K), *Eyles* 158 (BM, SRGH), *Garley* 628 (K, SRGH); Matoppos (-AD), *Eyles* 3761 (SRGH); Black Land Paddocks, *Rattray* 440 (BM, K); Matobo, Schumbashaba farm, *Miller* 2569 (K, PRE, SRGH); Essexvale (-BD), *Cheeseman* 16 (BM).

—2030 (Fort Victoria)? Victoria, *Monro* 2234 (S).

NAMIBIA—1715 (Ondangua): Oshikango (-BD), *Rodin* 9360 (WIND, M).

—1815 (Okahakana): Onolongo (-BC), *Barnard* 378 & 132 (SAM).

- 1816 (Namutoni): 30 mls SE of Ondangua (-AA), *De Winter* 6938 (PRE).
 - 1819 (Karakuwisa): Cigarette NE of Karakuwisa (-DD), *Maguire* 2292 (NBG).
 - 1917 (Tsumeb): Tsumeb (-BA), *Dinter* 1840 (SAM).
 - 1918 (Grootfontein): Grootfontein (-CA), *Dinter* 2385 (SAM); Farm Bloekane distr. Grootfontein, *Rehm s.n.* (M); Bubus (-CA), *Dinter* 860 (SAM).
 - 1920 (Tsumkwe): 6 km ostlich Tsumkwe (-DA), *Giess, Watt & Snyman* 11027 (PRE, WIND, M, S); 157 mls E of Grootfontein (-DA), *Story* 6156 (PRE, WIND, M); Nama Pan (-DC), *Story* 5313 (PRE), *Maguire* 2142 (NBG); Gautscha Pan (-DC), *Maguire* 2190 (NBG).
 - 2115 (Karibib): Near Karibib (-DD), *Kinges* 3189 (PRE, M).
 - 2117 (Otjosondú): Omipanda (-BD), *Wulffhorst* 45 (Z); Quickborn, (-AA), *Bradfield* 146 (PRE).
 - 2215 (Trekopje): Donkerhuk (-DD), *Barnard* 79 (PRE, WIND).
 - 2216 (Otjimbingwe): Friedenau, Khomas Hochland (-DB), *Gasner* 160 (M).
 - 2217 (Windhoek): Farm Frauenstein (-AD), *Giess* 13901 (PRE); Ostl. Auasberge (-CA), *Dinter* 403 (Z); Nordanläufer der Auasberge, *Dinter* 1870 (SAM). Goreangab dam, *Giess* 8395 (WIND); Distr. Windhoek, *Volk* 11168 (M).
 - 2219 (Sandfontein): Sandfontein (-BD), *Bleek* BOL 17247.
 - 2316 (Nauchas): Abbabis (-CC), *Dinter* 1456 (Z).
 - 2317 (Rehoboth): Farm Bergland (-AC), *Merxmüller & Giess* 1278 (BR, K, M, WIND). Rehoboth-Aub, *Dinter* SAM 73068 (SAM); Ca. 20 mls N of Uhlenhorst (-DB), *Boshoff & Mason* 3619 (PRE).
- S.W.A.: Lichtenstein, without precise locality, *Dinter* 4311 (B, BM); Heufeld, *Volk* 452 (M).

BOTSWANA—1822 (Kangara): Dobe (-DD), *Lee* 103 (SRGH).

- 2023 (Kwebe Hills): Near Kwebe Hills, Ngamiland (-CA), *Lugard* 282 (K).
- 2027 (Plumtree): 4 mls S of Tsessebe (-DC), *Leach & Noel* 298 (K, SRGH).
- 2220 (Kalkfontein): Near Mamumwe, Kalahari desert (AA/C), *Lugard* 237 (K).
- 2322 (Kang): 50 mls N of Kang (-DB), *Wild* 5066 (SRGH).
- 2424-25 (Dikgomo di kae—Gaberone): Letlhakeng-Sesung road, *Wild* 4977 (SRGH).

CAPE—2723 (Kuruman): Esperanza (-AD), *Ferrar* 6575 (KMG), *Es-terhuysen* 2219 (BOL); Kormutsetla (-BB), *Cross* 10088 (PRE).

This widely distributed species is readily distinguished from all South African species of *Ferraria* by its lax habit, long naked internodes with zones of gummy exudation below the cymes, and by its very short ovary without a rostrum.

Its flowering period varies widely, from November in tropical countries, to April or even May in southern localities. In the tropics it often flowers before development of the new season's corm.

It stands closest to section *Ferraria* which it resembles in its parallel anther lobes, narrow style arms and small terminal stigmas, and in its perianth with a

wide, rather shallow cup. In flower colouring it resembles *F. crispa*, varying in a similar manner. The flowers are described as scentless or almost scentless.

Carter (1963), examining the types of tropical African Iridaceae in the Kew herbarium, found four species described by Baker and by Bolus to be conspecific with *F. glutinosa*; and Goldblatt (1977) discovered under *Moraea* several more species names which are also synonymous with this species. In the course of the present investigation the types of all the synonyms, except three in Berlin, were reinvestigated and found to be conspecific with *F. glutinosa*, with the exception of *M. andongensis* Bak., the type of which in K, as well as Baker's description of its corm, (''fibris multis gracilibus praeditum'') shows that this is not a *Ferraria*. But Rendle (1899), working with the type material in the BM which is undoubtedly a *Ferraria*, transferred *M. andongensis* to *Ferraria*, and corrected Baker's description of the corm.

With the large amount of material now available for investigation from various herbaria, it is clear that the characters such as plant size, size and shape of the corm, number of flowers to a cyme, and flower colouring, used by Baker and other workers to distinguish their species, form continuous variations, so that no demarcations can be drawn to delimit separate species or even subspecies. As Carter suggested, plant size is undoubtedly influenced by environmental conditions and by the age of the plant; variation in flower colouring, however, is not due to age but is genetically fixed, as in the case of several of the southern species.

II SECTION FERRARIA

Stem much branched and densely foliose except in *F. densepunctulata*. *Cymes* generally 2-flowered. *Perianth claws* forming a wide bell-shaped cup 8–10 mm deep, with narrow slits between the claws. *Nectaries* 3–6 mm wide, usually wider than long, 1–4(–7) mm above the bases of the claws. *Anthers* with parallel thecae. *Ovary* 12–25 mm long, not rostrate or rarely with a rostrum ca. 8 mm long; *style* with deeply bifid or bipartite branches, the arms narrow, spreading sideways with minute terminal stigmas. *Capsule* usually not rostrate.

Chromosome numbers: $2n = 20, 40, 60$.

Type species: *F. crispa* Burm.

This section, comprising four species, has three species closely related, and the fourth, *F. densepunctulata*, differing in habit, leaf shape and anatomy, and in flower colouring. The leaves usually have two larger veins which form a pseudo-midrib. Epidermal papillae are lacking except in some collections of *F. schaeferi*. The larger veins lie with their sclerenchyma against the epidermis, except in *F. densepunctulata*. Pollen grains show a heterobrochate sculpture.

This is the only section in which hexaploids occur. These show remarkable fertility, indicating possible allopolyploid origins.

Distribution: Mostly in coastal districts from Lüderitz in Namibia to the Cape Peninsula, and eastwards to Mossel Bay, as well as to Oudtshoorn and Willowmore.

2. **Ferraria foliosa** Lewis, in Ann. S. Afr. Mus. **40**: 117 (1954). *Type*: Cape, near Elandsbaai, *Lewis 2301* (SAM 60809) (SAM, hol.; STE, iso.).

Icons: Lewis l.c. p. 118; this work Figs 18, 11A.

Plants 300–600(–900) mm tall. *Corm* depressed globose or somewhat cone-shaped, 20–50 mm diam. *Stem* 300–600(–750) mm long, stout, foliose, hidden by leaf sheaths. *Cataphylls* 2–3, unspotted. *Foliage leaves* numerous, 120–250 mm long, spirodistichous in large plants, glaucous, scimitar-shaped, spreading almost horizontally or slightly recurved, with wide, seemingly inflated sheaths up to 50 mm wide (folded), with pale membranous margins and numerous parallel veins, narrowing to short unifacial laminas ca. 6–8 mm wide, obtuse and mucronulate or subacute. *Cymes* numerous, 2-flowered. *Spathes* often keeled towards obtuse or subobtuse tips, with narrow, pale, membranous margins; outer 30–35 mm long, inner 40–45 mm long. *Flowers* 40–45 mm long, with an unpleasant mouldy odour, dark maroon or dark purple, velvety, with yellow-brown or brownish-green margins. *Perianth cup* widely bell-shaped, 10 mm deep, 15–18 mm diam. at the rim, with narrow slits between the claws, spotted inside, the claws with a swollen median zone; *nectaries* deeply bilobed, concave, ca. 2 mm above the claw bases, ca. 4 × 3 mm, shiny black or with dark spots, and with a narrow, pale upper margin often giving a 12-rayed pattern inside the cup; *segments* acuminate, outer segments 33–35 × 12–15 mm, often somewhat eared above the claws, inner 30–32 × 10–12 mm. *Filament tube* 6–8 mm long, often spotted, the free upper portions 2–3 mm long, slightly patent; *anthers* with parallel thecae, at first ca. 5 mm long, later 2 × 2 mm, dark on the backs, with orange pollen. *Ovary* 15–20 mm long, without a rostrum; *style* 8 mm long, the branches 4–5 mm long, deeply cleft into two curved, sideways spreading acuminate arms, the fimbriae sparse, blotched, ca. 3–5 mm long; *stigmas* minute, terminal on the style arms. *Capsules* ellipsoid or shortly cylindrical, 28–35 mm long, erostrate; *seeds* 3 mm diam., golden brown, with a shiny, finely wrinkled testa.

Chromosome number: $2n = 20$.

Flowering period: August to October. Each flower remains open for one day (10–16 hours).

Distribution: A coastal species growing in deep coastal sand, from just above the high water mark to 15 km inland, from Groenrivier mouth to Elands Bay, over a distance of ca. 130 km.

CAPE—3017 (Hondeklipbaai): At coast, Groenrivier mouth (–DC), *De Vos 2396* (STE).

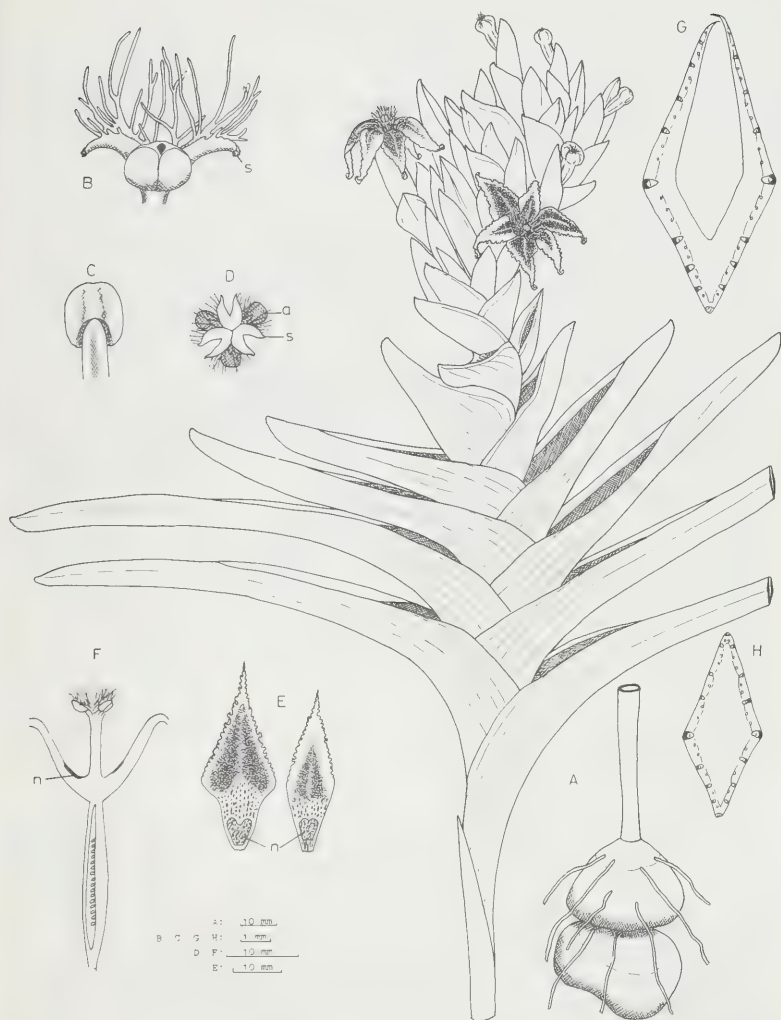


FIG. 18.

Ferraria foliosa. A, plant; B, one style branch and anther, lateral view; C, anther with free part of filament, adaxial side; D, style branches and anthers as seen from above; E, outer (left) and inner (right) perianth segments; F, longitudinal view of perianth claws, pistil and stamens; G, transverse section of middle of leaf; H, transverse section of upper part of leaf; a, anther; n, nectary; s, stigma.

—3218 (Clanwilliam): Otterdam (-AB), *Compton* 24162 (NBG, BOL); Soutpansklipheuwel, *Stirton* 6081 (STE); Near Verlorevlei, Elands Bay (-AD), *Lewis* 2301 (SAM); Verlorevlei, *Leighton* 156 (BOL), *Compton* 15063 (NBG); NE side of Verlorevlei at Matjiesgoed Drift, *Pillans* 8127 (BOL); Sandy coast Elands Bay, *Pillans* 8095 (BOL), *De Vos* 2318, 2365 (STE); 2 mls from Elands Bay, *Barker* 6377 (BOL); Near Elands Bay, *Lewis* SAM 60869 (PRE); $\pm$ 10 km S van Elandsbaai, pad langs Yskortreinspoor, *Botha & Coetzee* 1712 (PRE).

This species is closely allied to both *F. crispa* and *F. schaeferi* and could perhaps have been a parent species of these polyploid species. In geographical range it occurs between the areas of these polyploids, overlapping *F. crispa* in the latter's northernmost range, and separated from *F. schaeferi* by a distance of about 80 km; but as the flora of the west coast has not been investigated fully, this interval is probably much less.

F. foliosa differs from *F. crispa* firstly in being diploid, secondly in its shorter, more glaucous, horizontally spreading leaves with wider, inflated leaf sheaths and short unifacial blades. The flowers are similar in their stamens and pistils and almost similar in their nectaries. The perianth resembles the dark flowered specimens of *F. crispa*.

The leaves of *F. foliosa* differ from *F. schaeferi* in their larger, bifacial sheaths and shorter unifacial blades, and in having a smaller amount of water-storing tissue; the flowers differ in the former having a longer, darker perianth with longer tapering segments, a shorter, erostrate ovary, and acuminate style branches.

Miller's (1759a) figure 280 is perhaps this species, as to habit, but not as to flower shape and colour (pale sky-blue).

3. *Ferraria crispa* Burm., Nova Acta Acad. Caes. Leop-Car. 2: 199 (1761); Moore, in *Baileya* 19: 110 (1974). *Iconotype*: Burman l.c. t.3 f.1.

Plants 200–500(–800) mm tall. *Corm* almost symmetrical, depressed globose, or irregular, 15–30(–40) mm diam. *Stem* 150–300(–500) mm long, often rather stout, wholly or partly hidden by leaf sheaths. *Cataphylls* 2–3, often mottled with red. *Foliage leaves* numerous, lower leaves distichous, suberect or slightly spreading, 150–300(–800) mm long, with sheath to 15 mm wide (folded), with narrow, pale or often reddish spotted margins and a long unifacial lamina 5–12 mm wide, thickened in the middle with a prominent midrib, narrowing to an acute or obtuse and mucronulate, or slightly incurved tip; upper leaves shorter, slightly spreading, largely sheathing. *Cymes* numerous, 2-flowered, rarely with 3 flowers. *Spathes* slightly keeled towards their tips, subacute or subobtuse, cuculate, outer 30–45 mm long with narrow, pale or reddish-brown spotted margins, inner 50–65 mm long, with wider colourless margins. *Flowers* 45–50 mm long, with an unpleasant putrid odour, dark brown, maroon or almost black (nearest RHS 200A)



FIG. 19.

Ferraria crispa subsp. *crispa*. A, plant; B, one style branch and anther, lateral view; C, style branches and anthers seen from above; D, anther and free part of filament, adaxial view; E, outer (left) and inner (right) perianth segments, of spotted colour variation; F, base of flower; G, transverse section of leaf blade; a, anther; n, nectary; s, stigma.

often with pale lines and blotches, or cream to pale yellow and variously striped and blotched with dark brown or maroon, and with brownish-green margins. *Perianth claws* forming a widely bell-shaped cup 8–10 mm deep, 10–15 mm diam. at the rim, with narrow slits between the claws; *nectaries* 2–3-lobed, concave, 1–2 mm above the claw bases, $2-3 \times 3-6$ mm, on the outer segments wider than long, almost black with a few pale spots, or pale with dark spots; *segments* acuminate, outer segments 25–30 $\times$ 10–17 mm, often eared above the claws, inner 22–27 $\times$ 6–10 mm. *Filament tube* 6–8 mm long, reddish brown or mottled, the free upper portions 2–3 mm long; *anthers* horizontal, with parallel thecae, at first 4.5–6 mm long, later $2-2.5 \times 2$ mm, often black on the backs, with orange pollen. *Ovary* 15–25(–30) mm long, 1.5–2 mm diam. at the top, not rostrate, but the top 5–7 mm without ovules; *style* 7–9 mm long, the branches 3–4 mm long, deeply cleft into two slender tapering, curved, sideways spreading arms, the fimbriae in a dense tuft, 3–4 mm long, mottled; *stigmas* minute, terminal on the style arms. *Capsules* ellipsoid 17–25 mm long, with a pointed erostrate tip; *seeds* 2.5–3 mm diam., golden brown, with shiny, wrinkled testa.

Chromosome numbers: $2n = 40, 60$.

Flowering period: July to October. Each flower remains open for one day only.

Distribution: A predominantly south-western lowland species occurring from Lamberts Bay and Clanwilliam to the Cape Peninsula, Bredasdorp and Mossel Bay, with inland outliers to the Cedarberge, Ceres, Oudtshoorn and Willowmore; in sand or sandy loam.

F. obtusifolia, known only from Sweet's drawing and description, is probably this species. Its flower structure and obtuse leaves are typical of both *F. crispa* and *F. foliosa*. It agrees, however, more with *F. crispa* than with *F. foliosa* in its more erect, not horizontally spreading leaves, with narrow sheaths which are spotted with red towards the base of the shoot, and in its flower cup which is striped inside—a feature occurring in some specimens of *F. crispa*, but not, as far as known, in *F. foliosa*.

F. vandermerwei from Swellendam is this species. The ovaries of the type specimen were found to be not 3 cm long and rostrate as described by L. Bolus, but only 25 mm long, with the top 7 mm sterile, as often occurs in *F. crispa*.

Miller (1758b, 1768) misidentified the two species described by Burman (1761); he regarded *F. fimbriata* Burm. as *F. undulata*, and named *F. crispa* Burm. *F. ensiformis*.

Two subspecies are now recognised which differ in geographical distribution, chromosome numbers, and to some extent in flowering period and size of certain floral organs. Several of the older herbarium specimens which have no laid out flowers and which were collected from areas intermediate between the known habitats of the two subspecies, could not be distinguished with certainty.

The subspecies occurring near the Cape is probably the one described by Burman; this is therefore regarded as the typical subspecies.

KEY TO DISTINGUISH THE SUBSPECIES

Perianth cup ca. 10 mm deep, 12–15 mm diam. at the rim; inner segments ca. 10 mm wide (rarely only 8 mm); from Saldanha Bay towards the south and east. a. subsp. **crispa**
 Perianth cup ca. 8 mm deep, ca. 10 mm diam. at the rim, inner segments 6–7 mm wide; distribution mainly in the Clanwilliam district and towards Piketberg. b. subsp. **nortierii**

a. subspecies **crispa**

Ferraria crispa Burm., Nova Acta Acad. Caes. Leop.-Car. **2**: 199 (1761); Moore, in Bailey **19**: 110 (1974).

F. undulata L., Sp. Pl. ed. 2, **2**: 1353 (1763), nom. superfl., & Syst. Nat. ed. 13: 597 (1770); Jacq., Hort. Vind.: 25 (1770); Cav., Diss. Bot. **6**: 343 (1788); Lam., Encycl. Bot. **2**: 453 (1788); Curtis, Bot. Mag. **4**: 144 (1791); Salisb., Prodr. Stirp.: 42 (1796); Willd., Sp. Pl. **3**: 580 (1800); Ker, in Kon. & Sims, Ann. Bot. **1**: 242 (1805) & Irid. Gen.: 28 (1827); Ait., Hort. Kew. **2**: 136 (1812); Roem. & Schult., Syst. Veg. **1**: 495 (1817); Spreng., Syst. Veg. **1**: 169 (1825); Eckl., Top. Verz.: 18 (1827); Bak., in J. Linn. Soc. Bot. **16**: 106 (1877) & Handb. Irid.: 73 (1892) & in Fl. Cap. **6**: 30 (1896); Lewis, in Adams. & Salter, Fl. Cape Penins. 224 (1950) & in Flow. Plants S. Afr. **33**: 1316 (1959); non Miller 1768.

Moraea undulata Thunb., Diss. Moraea p. 14 & 17 (1787) & Prodr.: 11 (1794) & Fl. Cap.: 279 (1807) & p. 72 (1823).

Ferraria undata Wännman, Fl. Cap. 370 (1759), nom nud.

F. ensiformis Miller, Gard. Dict. ed. 8 (1768).

F. punctata Pers., Syn. Pl. **1**: 50 (1805).

F. obtusifolia Sweet, Brit. Fl. gdn. ser. 1, 2 t.148 (1826), *iconotype*; Bak., in J. Linn. Soc. Bot. **16**: 106 (1877) & Handb. Irid. 73 (1892) & in Fl. Cap. 6:31 (1896).

F. major Eckl., Top. Verz.: 18 (1827), nom. nud.; Nordenstam, in Jl S. Afr. Bot. **38**: 295 (1972) pro syn.

F. vandermerwei L. Bol., in S. Afr. Gard. **22**: 276 (1932). *Type*: Cape, near Swellendam, Van der Merwe BOL 20168 (BOL, holo).

[*Flos indicus e violaceo fuscus* . . . Ferrari, Fl. Cult. 168 & t.171 (1646).

Gladiolus indicus e violaceo fuscus . . . Morison, Hist. **2**: 344, S.4. t.4, f.7. (1680). *Narcissus indicus flore saturate purpureo* . . . Rudbeck, Elys. 2, t.49 f.9 (1701). *Iris stellata cyclamine radice pullo flore* . . . Barrelier, Ic. 1216 (1714)]

Icones: Burman 1761 t.3 f.1, *iconotype*; Jacquin 1770 t. 63; Curtis's bot. Mag. t.144 (1791); Redouté 1803 t.28; Kidd 1950 t.53.2; Rice & Compton 1950 t.191.2; Mason 1972 t.25.2; Flow. Plants S. Afr. **33** t.1316 (1959); this work Figs 19, 12, 5, 6.

Leaves somewhat glaucous. *Perianth cup* ca. 10 mm deep, 12–15 mm diam. at the rim; *inner segments* ca. 10 mm wide (rarely only 7–8 mm). *Anthers* in bud 6 mm long, shrinking to 2.5 mm; *pollen* averaging 130 μ m in length. *Ovary* 20–25 mm long, 3–3.5 mm diam.

Hexaploid: ($2n = 60$).

Flowering period: usually September to October, sometimes from August.

Distribution: Over more than 400 km from Saldanha Bay to the Oudtshoorn and Willowmore districts.

This subspecies probably originated from the tetraploid subspecies, after hybridising with a diploid, perhaps *F. foliosa*, which occurs within the range of the tetraploid.

CAPE—3217 (Vredenburg): Sandy banks north of Saldanha Bay (-DD), *Hutchinson* 285 (K).

—3218 (Clanwilliam): Prope ostium flumen Berg River (-CC), *Bolus* 6301 (BOL, PRE).

—3219 (Wuppertal): Warm Bath, Citrusdal (-CA), *Bolus* BOL 31222 (BOL).

—3317 (Saldanha): Danger Bay (-BB), *Hall* 759 (NBG); Baviaanskop, Saldanha (-BB), *De Vos* 2323 (STE).

—3318 (Cape Town): Langebaan, Saldanha Bay (-AA), *Lewis s.n.*, *Leighton & Lewis s.n.*, Sept. 1932 (BOL); Papkuilfontein, Darling (-AD), *Godfrey* PRE 28597; Between Darling & Mamre, *L. Bolus s.n.* 5 Aug; Near Darling, *Lewis* 1050 (SAM); Burgherspost, Mamre (-BC), *De Vos* 2324 (STE); Mamre Hills (-CB), *Barker* 3832 (NBG); Fifth gate to Gansekraal, *Barker* 2002 (NBG); Lions Head (-CD), *Lewis* 42 (SAM), *Barnard* NBG 167/45; Cape Town, *Marloth* 7242 (PRE), *Prior* PRE 35776; Mowbray, *Walters* 11 (PRE); Milnerton, *Lewis* 73 (SAM); Slopes Table Mt, *Lewis* 1604 (SAM), 2326 (SAM); Claremont, *French* SAM 12745; Camps Bay, *Thode* 9217, 9220 (STE); Robben Island (-CD), *Walgate* 496 (NBG); Bloubergstrand-Melkbosstrand, *De Vos* 76/43 (STE); Camps Bay, Lower Blinkwater Ravine, *Cassidy* 29 (NBG); Spieka, Klipheuwel (-DA), *Thompson* 2617 (STE); Dassenberg, *Pillans* 6844 (BOL); Jonkershoek, farm Waterfalls (-DD), *Oliver s.n.* Aug. 1974 (STE); Prom. b. Spei, *Thunberg* (S).

—3319 (Worcester): Mostertshoekberg (-AD), *De Vos* 2383 (STE); Hex River Pass (-BC/D), *Barker* 7454 (NBG); Karooport (-BC), *Ross-Frames* BOL 20073.

—3320 (Montagu): Kogmanskloof (-CC), *Lewis s.n.* Sept. 1935 (BOL).

—3322 (Oudtshoorn): Between Avontuur & Oudtshoorn, Diep River (-DA), *Hunt* NBG 2052/33 (BOL); Meiringspoort, Swartberge (-BC), *Loubser* sub *De Vos* 2351 (STE).

—3323 (Willowmore): Georgida (-AD), *Fourcade* 4411 (STE).

—3418 (Simonstown): Fish Hoek (-AB), *Marloth* 9409 (PRE); Hout Bay, *Dodd* 1758 (BOL); Strandfontein (-BA), *Compton* 13705 (NBG), *Taylor* 8173 (STE); Faure, dunes S of Kramat, *Jordaan* 666 (STE); Cape Flats, *Rogers* 16967 (Z); Rooi Els (-BD), *Parker* 4374 (K, NBG, BOL).

—3419 (Caledon): Hermanus Botanical Garden (-AC), *Jeppe* PRE 15513; Hermanus, *Du Plessis* STE 19725, *Beyers* SAM 60143, *Rogers* 26567 (PRE), 26496 (Z); Near Hermanus, *Ross-Frames* NBG 2339/30 (BOL); Hermanus, rocky sandy

places by coast, *Gillett* 22 (STE); Kleinmond, *De Vos* 2360 (STE); Danger Point, *Lewis* 2747 (SAM).

—3420 (Bredasdorp): Near Swellendam (-AB), *Van der Merwe* BOL 20168; Malagas (-BC), *Ross Frames* BOL 20074; Arniston (-CA), *Chamberlain* 81 (BM); Springfield Estate, *Stokoe* SAM 60185; 5–8 km N of Struisbaai (-CC), *De Vos* 2382 (STE).

—3421 (Riversdale): Albertinia (-BA), *Muir* 4618 (SAM); Albertinia commonage, *Muir* 5479 (PRE); Ystervarkpunt between Gouritzmond & Stilbaai (-BC), *Rycroft* 3119 (NBG); The Fisheries (-BD), *Acocks* 21567 (K, PRE); 1 ml N of Gouritz River Mouth, *Mauve* 4755 (PRE); Vleesbaai, *De Vos* 2293 (STE).

—3422 (Mossel Bay): Mossel Bay (-AA), *Rogers* Oct. 13. 1860 (K); Klein Brak River, *Burchell* 6196 (K).

C.B.S. sine loco: *Sparrman* s.n. (BM); *Oldenburg* 540 (BM).

AUSTRALIA: Hill St., Perth, *Morrison* s.n. 6.9.1898 (BM); East of Perth, *Morrison* 8408 (K).

b. subspecies **nortierii** De Vos, subsp. nov.

A subsp. *crispa* chromosomatum numero tetraploideo, segmentis interioribus perigonii 6–7 mm latis, anthesi praecoci, distributione geographica septentriones distinguatur.

Type: Cape, Clanwilliam, heights north of Elandsbaai, *De Vos* 2366 (STE, holo.).

Leaves green. *Perianth* cup ca. 8 mm deep, ca. 10 mm at the rim; *inner segments* usually 6–7 mm wide. *Anthers* in bud 4.5 mm long, shrinking to less than 2 mm; pollen averaging 110 μ m in length. *Ovary* usually less than 20 mm long, 2.5–3 mm diam.

Tetraploids: (2n = 40).

Flowering period: July to September.

Distribution: Over a small area on the northern border of the range of *F. crispa*, mainly in the Clanwilliam district. In sandy soil, usually amongst rocks.

The flowers usually have a pale yellow perianth with dark brown margins, spots and blotches.

The name of the subspecies is in honour of Dr P. L. Nortier of Clanwilliam, noted physician and biologist.

CAPE—3118 (Vanrhynsdorp): Nardouwsklouf (-DD), *Stokoe* SAM 59837.

—3218 (Clanwilliam): Nortier Expt. Station N of Lamberts Bay (-AB), *Van Breda* 4282 (STE); Otterdam, *Compton* 24162 (BOL); Rocky outgrowth some 2 km N of Lamberts Bay, *De Vos* 2374 (STE); 10 mls from Lamberts Bay towards Graafwater, *Lavis* s.n. Sept. 1934 (BOL); Heights N of Elands Bay (-AD), *De*

Vos 2354, 2366 (STE); Ventersklip N of Verlorenvlei, *Boucher* 2831 (STE); Rocky kopje, Graafwater (-BA), *Adamson* SAM 39048; 3 km E of Graafwater, *De Vos* 2375 (STE); Between Langevallei & Heerenlogement, *Drège s.n.* (partly, K, S); Pakhuis (-BB), *Leipoldt* BOL 20779, BOL 20838; Kleinkliphuis, Pakhuis, *De Vos* 2368 (STE); Clanwilliam, *Schlechter* 8584 (BOL, PRE, BM, Z); The Weir, Olifants River valley, *Leighton & Lewis s.n.* Sept. 1932 (BOL); Rocky koppie across Olifants River towards Algeria (-BD), *De Vos* 2376 (STE); Olifants River valley, *Lewis s.n.* Sept. 1932 (BOL); Piketberg top (DC), *De Vos* 2401 (STE), *Barker* 10266 (NBG).

—3219 (Wuppertal): Geelkrans on Vlakrug Farm (-CA), *Van der Merwe* 245 (STE).

4. *Ferraria schaeferi* Dinter, in *Reptium nov. Spec. Regni Veg.* **16**: 339 (1920); Sölch, Diss. Univ. München: 128 (1961); Sölch & Roessl, in *Merxm., Prodr. Fl. SWA.* **155**: 4 (1969). Neotype: Schäfer 562 (B).

Type: The holotype, *Schäfer* 597, was probably in Berlin-Dahlem (B). This herbarium still houses a sheet with a single small specimen comprising the top part of a shoot, and with a label: “*Schäfer* 562 *Ferraria schaeferi* Dtr, Zipfel der Dreikugelberges Klinghardttsgebirge”, and below that, on the same label in pencil, in a different handwriting: “No. 597 Granitberg zw. Prinzenbucht u. Bogenfels”. Probably this specimen is not the holotype but represents *Schäfer* 562, its locality being about 40 km from that of the holotype. This specimen is chosen as neotype in the absence of the holotype.

Plants 200–500 mm tall. *Corm* depressed globose, irregular, subconical, or flattened or concave above, 15–40(–70) mm diam. *Stem* 150–400 mm long, rather stout, foliose, covered with leaf sheaths. *Cataphylls* 2–3, pale, sometimes reddish towards the top. *Foliage leaves* numerous, scimitar-shaped or ensiform, distichous or spirodistichous, spreading or recurved, somewhat succulent, glaucous, up to 300 mm long, with up to 20 mm wide sheaths, narrowing to unifacial laminas to 10 mm wide, somewhat succulent, acute to obtuse; upper leaves horizontal or recurved. *Cymes* generally numerous in a dense cluster, each 2-flowered. *Spathes* with narrow, pale, membranous margins, acute to obtuse, outer 35–40 mm long, inner 50–55 mm long. *Flowers* ca. 50 mm long, rather sweetly scented, yellow with dark brown spots and blotches and with the upper one-quarter and margins dark brown, or dark brown with yellow spots. *Perianth cup* widely bell-shaped, 8 mm deep, 12–15 mm diam. at the rim, with narrow slits between the claws, pale yellow densely dotted with dark brown inside, the claws swollen in the median zone towards their bases; *nectaries* bilobed or bipartite, somewhat concave, 3 × 3–4 mm, brown dotted, 1–2 mm above the bases of the claws; *segments* almost rhomboidal, acute to acuminate, outer segments ca. 25 × 12 mm, inner ca. 22–24 × 9–10 mm. *Filament tube* ca. 7–8 mm long, brown streaked, the upper free portions 2–3 mm long; *anthers* with parallel thecae, at

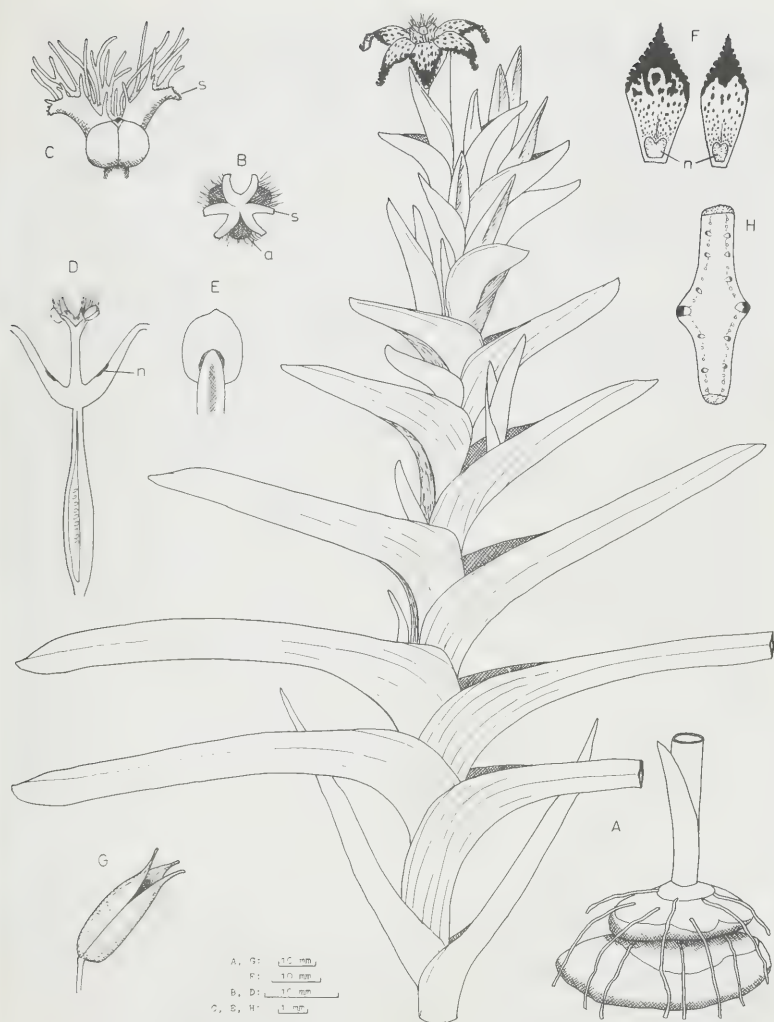


FIG. 20.

Ferraria schaeferi. A, plant; B, style branches and anthers, seen from above; C, one style branch and anther, lateral view; D, base of flower, longitudinal view; E, anther and free part of filament, adaxial view; F, outer (left) and inner (right) perianth segments; G, capsule; H, transverse section of leaf blade; a, anther; n, nectary; s, stigma.

first 5 mm long, later 2.5×2 mm, dark on the backs; pollen brownish-yellow to orange. Ovary triquetrous, ca. 25 mm long, with a slender rostrum ca. 8 mm long; style 8–9 mm long, the branches 4 mm long, cleft halfway down, with curved sideways spreading truncate arms, fimbriae sparse, 2–5 mm long, dark brown or blotched with yellow; stigmas small, terminal. Capsules ellipsoid, 25–35 mm long, with pointed, shortly rostrate tip; seeds 3–4 mm diam., shiny, golden brown, angled by pressure.

Chromosome number: $2n = 40, 60$.

Flowering period: August to September. Each flower remains open for one day.

Distribution: Sparsely distributed over a wide part of the arid northernmost winter rainfall region, from northern Namaqualand to the southern Namib near Lüderitz, and from the coast to the Buchberge and Haalenberg ca. 40 km inland; mainly in deep coastal sand.

NAMIBIA—2615 (Lüderitz): Lüderitzbucht (-CA), *Knobel* SAM 12783; Roadside opposite Haalenberg (-CB), *De Vos* 2393 (STE); Opposite Elizabeth Bay (-CD), *De Vos* 2379 (STE).

—2715 (Bogenfels): Pomona (-AB), *Merxmüller & Giess* 28423 (M); Granitberg near Pomona, *Marloth* 5249 (PRE); Granitberg zw. Prinzenbucht u. Bogenfels, *Schäfer* 597 (B?); Near Schwartz Klippe (-AD), *Kinges* 2683 (M); Klinghardtgebirge (-BC/D), *Schäfer* 562 (B); Wasserschlucht i.d. Buchubergen (-DD), *Dinter* 6584 (BM).

CAPE—2916 (Port Nolloth): Port Nolloth (-BB), *Galpin & Pearson* 7447 (K); Muisvlak (-BB) *De Vos* 2394 (STE); 10 km from Port Nolloth towards Steinkopf (-BD), *De Vos* 2392 (STE).

—2917 (Springbok): Grootmis, sanddune (-CA), *De Vos* 2391 (STE).

This species has also been found by J. Coetzer of the Consolidated Diamond Mines at Swartberg near Grillental (-Bogenfels -AB) and at Oranjemund (Bogenfels -CD). It is closely related to *F. crispa* and *F. foliosa*, and differs in the possession of a shortly rostrate ovary, minutely truncate style arms and flowers sweetly scented, and from the former also in its more glaucous, more succulent, spreading leaves with shorter unifacial upper part, and flowers with larger brown blotches on the perianth. It further differs from *F. foliosa* in flower colouring and shorter perianth segments. Its leaves resemble those of *F. foliosa* and this diploid species is probably one of its parents. The two species are separated by an interval of about 80 km; but as the west coast has not been investigated fully, the interval is probably much narrower.

5 *Ferraria densepunctulata* De Vos, spec. nov.

Caulis 80–330 mm longus, internodiis inter vaginas foliorum partim manifestis. *Folia* inferiora suberecta, laminis compresso-cylindraceutis, ad 5 mm diam.,

subacutis vel subobtusis, vaginis 5–8 mm latis; folia superiora breviora, fere horizontaliter patentia, vaginis latoribus, apicibus interdum incurvatis. *Cymae* plures, biflorae. *Spathae* marginibus membranaceis, angustis, rubris vel pallidis, spatha exterior 30–40 mm longa, interior 40–50 mm longa, obtusa vel aliquantum cuculata. *Flores* ca. 35–45 mm longi, fere inodorati, segmentis exterioribus differentibus ab interioribus amplitudine et forma et notis. *Perigonium* unguibus cupulam late campanuliformem facientibus, rimis inter ungues, *nectariis* bilobis vel bipartitis, nitidis, 2–7 mm supra bases unguum positis; *segmenta* cinerea vel e cinereo viridia, marginibus undulatis crispulatisque, segmenta exteriora dense punctulata, unguibus 7–10 mm latis, segmenta interiora macula grandi vinacea vel purpurea ornata, unguibus ca. 2 mm latis in dimidio inferiore. *Tubus filamentorum* 8–10 mm longus, partibus liberis superioribus 2–3 mm longis; *antherae* thecis parallelis, horizontales. *Ovarium* interdum exsertum, 12–15 mm longum, eros-tratum; *stylus* 10–12 mm longus, ramis bifidis, brachiis tenuibus curvatis, laterale-patentibus, fimbriis erectis 5–8 mm longis ramosis; *stigmata* ut in *F. crispa*. *Capsula* ellipsoidea vel ovoidea, erostrata; semina testa rugosa. Chromosomatum numerus $2n = 20$.

Type: Cape, Clanwilliam, Elandsbaai, Loubser sub *De Vos* 2317 (STE, holo.).

Plants 120–350 mm tall. *Corm* almost symmetrical, depressed globose to almost disc-shaped, saucer-shaped or sometimes pyramidal, to 50 mm diam. *Stem* 80–330 mm long, internodes partly visible between leaf sheaths. *Cataphylls* 2, often dark reddish-purple towards the tip. *Foliage leaves* few, usually distichous, bright green or sometimes with a slight bloom, lower 1–4 leaves suberect, 100–250 mm long, with laminas compressed cylindrical, up to 5 mm diam., subacute to subobtuse, sheaths 5–8 mm wide with narrow, pale or reddish-brown, membranous margins; upper leaves shorter, spreading almost horizontally, with wider sheaths and tips sometimes incurved. *Cymes* several, 2-flowered. *Spathes* with narrow reddish or pale membranous margins; outer 30–40 mm long, acute, inner 40–50 mm long, obtuse or with a somewhat cuculate tip. *Flowers* ca. 35–45 mm long, almost odourless, with the outer perianth segments differing from the inner in size, shape and markings. *Perianth claws* forming a widely bell-shaped cup 8–10 mm deep, 15–20 mm diam. at the rim, with slits between the claws; *nectaries* bilobed or bipartite with two concave hollows, $1-2 \times 3-4$ mm, pale green or yellowish-green, shiny, 2–4 mm above the bases of the outer claws and 5–7 mm above the bases of the inner; *segments* pale grey (RHS 196A, D) or greyish-green, with undulate and minutely crisped margins, acute or obtuse; outer segments densely spotted with small maroon or purple dots, $28-30 \times 10-15$ mm, the claws 7–10 mm wide spotted, inner segments with a large maroon or dark purple blotch, $25-27 \times 7-10$ mm, with claws ca. 2 mm wide in the lower half. *Filament tube* 8–10 mm long, the free upper portions 2–3 mm long; *anthers* with

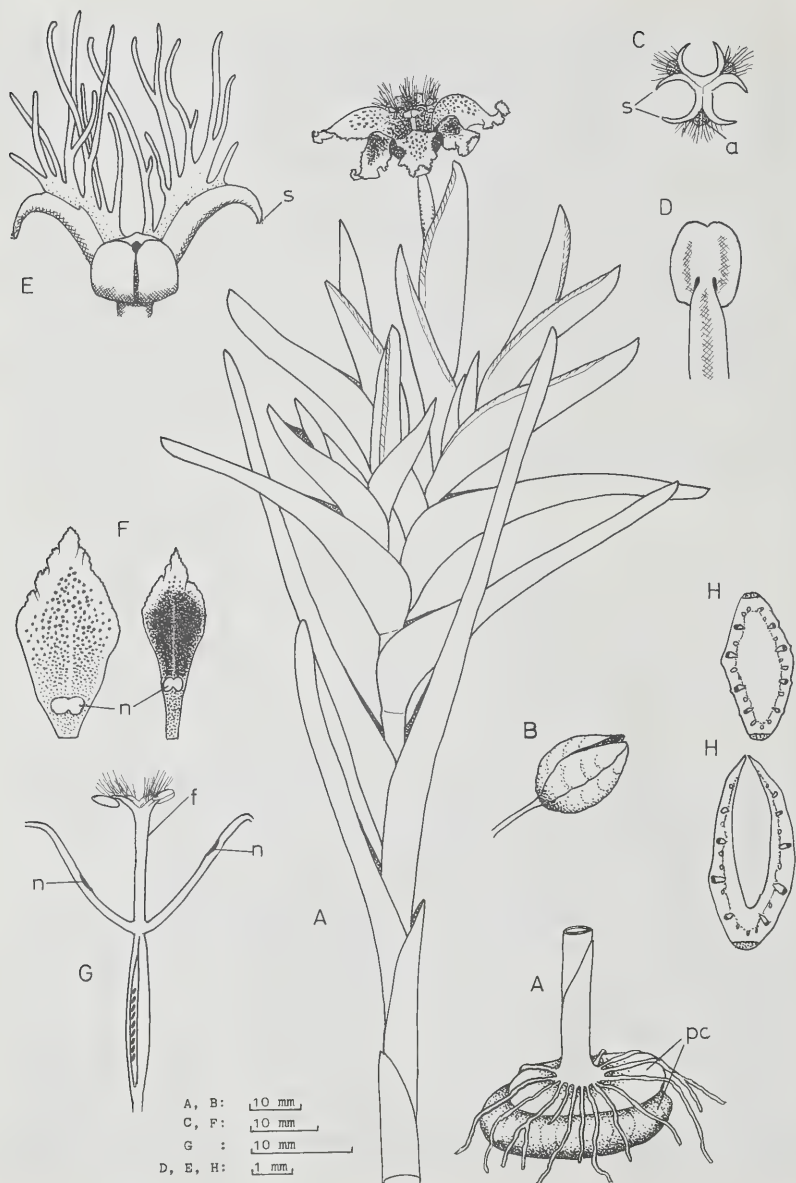


FIG. 21.

Ferraria densepunctulata. A, plant, *De Vos 2317*; B, capsule; C, top view of style branches and anthers; D, anther and free part of filament, adaxial view; E, one style branch and anther, lateral view; F, outer (left) and inner (right) perianth segments; G, base of flower, longitudinal view; H, transverse sections of leaf, upper half (above) and middle of leaf (below); a, anther; f, filament tube; n, nectary; s, stigma.

parallel thecae, at first 4–5 mm long, later 2×1.5 mm, horizontal, pollen orange to deep yellow. Ovary sometimes exserted, 12–15 mm long, not rostrate; style 10–12 mm long, the branches cleft about halfway down, with slender, acuminate, curved, sideways spreading arms and erect branched fimbriae 5–8 mm long; stigmas as in *F. crispa*. Capsule ellipsoid or ovoid, 15–25 mm long, not rostrate; seeds 3 mm diam., golden brown, testa wrinkled.

Chromosome number: $2n = 20$.

Flowering period: May to July. Flowers remain open for two days.

Distribution: Found over a distance of 120 km within 15 km from the coast, from Lamberts Bay to Langebaan, in coastal sand.

CAPE—3218 (Clanwilliam): Langdam near Lambertsbaai (-AB), *De Vos* 2298, 2342 (STE); Elandsbaai naby brug (-AD), *Loubser* 2240, 2192, *Loubser* sub *De Vos* 2317 (STE); Elands Bay near school, *Pamphlett* 98 (NBG).

—3318 (Cape Town): Langebaan hills behind hotel (-AA), *Leipoldt* 3844 (BOL).

This is the earliest flowering of the Cape *Ferraria* species. The flowers appear about a month after the appearance of the leaves and develop before the formation of the new corm. In this respect it resembles *F. glutinosa*.

In its fresh state it is readily distinguished by its pale greyish perianth with the outer segments densely spotted with small dark purple or maroon dots and the inner segments with a large purple or maroon blotch above the claws and sometimes also with faint dots. Other distinctive features are the parallel anther lobes, ovary without a rostrum, and the pale green, bilobed or bipartite nectaries situated several millimetres above the bases of the claws.

F. densepunctulata differs from other members of section *Ferraria* in its narrow, compressed cylindrical lower leaves, its early flowering period, and its flowers which have the outer perianth segments different from the inner in size, shape and markings, and which remain open for two days.

The species resemble *F. ferrariola* in its partly visible stem and short, horizontally spreading upper leaves with wide leaf sheaths; the lower foliage leaves are, however, shorter, more stiff, suberect and slightly wider than in *F. ferrariola*, and the flowers differ in several respects e.g. parallel anther lobes, exserted ovary and spotted perianth.

III SECTION MACROSCYPHAE (Bak.) De Vos emend.

Macroscyphae Bak., in J. Linn. Soc. **16**: 106 (1877), as species group.

Stem much or sparsely branched, densely foliose or with few leaves. Cymes 2-flowered. Perianth claws forming a narrow funnel-shaped, or sometimes a bell-shaped, cup (*F. divaricata*), (8–)10–15(–20) mm deep, usually with overlapping margins (except in *F. ferrariola*). Nectaries usually very small, basal on the claws or 1–3 mm above the bases of the inner claws. Anthers with thecae generally divaricating after dehiscence. Ovary with a sterile rostrum (8–)10–20

mm long; style with widened, flattened bifid branches; stigmas slightly elongated, grooved or flattened, on the margins of the flat style branches below tufts of fimbriae. Capsule ellipsoid, with a persistent rostrum.

Chromosome numbers: $2n = 20, 40$.

Type species: Baker (l.c.) placed only two species in his group *Macroscyphae*, namely *F. divaricata* and *F. ferrariola*, erroneously equating the latter with *F. antherosa*. *F. divaricata* Sw. has therefore been chosen as type species.

Distribution: In the western coastal, as well as inland districts, throughout Namaqualand to the south-western Cape districts (but not in the Cape Peninsula) and eastwards to Oudtshoorn, with extensions to the western Great Karoo and the Kalahari.

This section comprises five species, three of which, namely *F. uncinata*, *F. kamiesbergensis* and *F. brevifolia*, are closely related. *F. divaricata* is a large polymorphic species with several subspecies, one of which is tetraploid. *F. ferrariola* is intermediate between this section and section *Ferraria*. Anatomically the leaves usually have their large veins about equal in size, so that a midrib is usually not evident. Epidermal papillae occur in several species. A layer of parenchyma is often present between the sclerenchyma of the veins and the epidermis. The pollen exine has a finer and more uniform reticulation than in section *Ferraria*.

6. *Ferraria ferrariola* (Jacq.) Willd., Sp. Pl. ed. 4, **3**: 581 (1800); Ait., Hort. Kew. **4**: 136 (1812) excl. syn. Ker; Roem. & Schult., Syst. Veg. **1**: 496 (1817) excl. syn. Ker; Spreng., Syst. Veg. **1**: 169 (1825); Ker, Irid. Gen.: 28 (1827) excl. syn. Ker; Klatt, in Abh. Naturf. Ges. Halle **15**: 386 (1882) & in Dur. & Schinz, Consp. Fl. Afr. **5**: 156 (1895) excl. syn. Ker; Bak., in J. Linn. Soc. Bot. **16**: 106 (1877) excl. syn. Ker; non Ecklon, 1827.

Moraea ferrariola Jacq., Coll. Bot. **4**: 141 (1790) (basonym) & Hort. Schoenbr. **4**: 24 & t.450 (1804), *iconotype*.

F. viridiflora Andrews, Bot. Rep. **4**: 285 (1803), *iconotype*.

F. viridis Ker, in Curtis's bot. Mag. **20**: 751 (1804), pro syn., orth. error for *F. viridiflora* Andrews.

F. minor Pers., Syn. Pl. **1**: 50 (1805).

F. longa Barnes, in S. Afr. Gard. **20**: 313 (1930). Type: Cape, Nieuwoudtville, *Ross-Frames* BOL 19207 (BOL, holo.).

? *F. angustifolia* Sweet, Brit. Fl. gdn. sub t.192 (1827), sp. dub., no type found.

Misidentifications: *F. antherosa* Bak., Handb. Irid.: 72 (1892) pro parte & in Fl. Cap. **6**: 29 (1896) pro parte; *F. undulata* Klatt, in Linnaea **34**: 625 pro parte.

Icons: Jacquin 1804 t.450; Andrews 1803 t.285; S. Afr. Gard. **20**: 313 fig. A (original coloured drawing in BOL); this work Figs 22, 1, 5, 13A.

Plants 150–500(–600) mm tall, heterophyllous. Corms obliquely ellipsoid, in

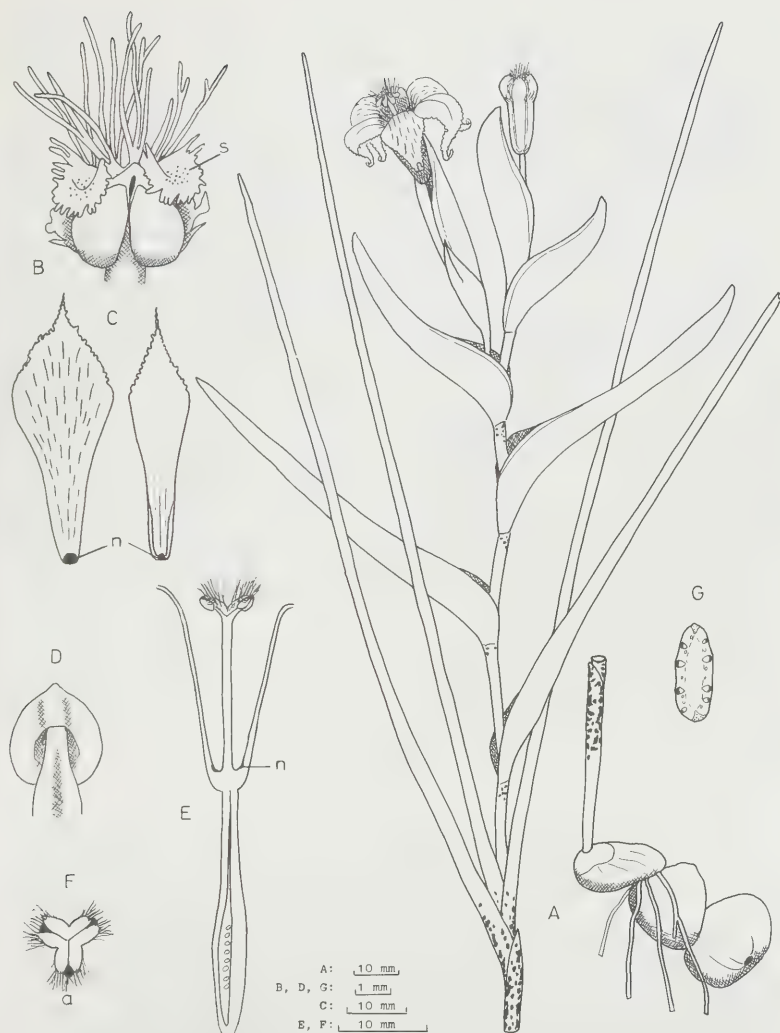


FIG. 22.

Ferraria ferrariola. A, plant; B, one style branch and anther, side view; C, outer (left) and inner (right) perianth segments; D, anther and free part of filament, adaxial view; E, base of flower, longitudinal view; F, top view of style branches; G, transverse section of leaf blade, a, anther; n, nectary; s, stigma.

an oblique row, 20–40 mm diam. *Stem* erect or slightly flexuose, 100–300 (–400) mm long, slender, often sparsely branched in the upper part, partly visible between the leaf sheaths. *Cataphylls* generally 2, reddish or densely red or purple spotted towards the top. *Foliage leaves* several, lower leaves 3–4, compressed cylindrical or subterete, acute, 150–450 mm long, 1–5 mm wide, with narrow, often red spotted sheaths; upper leaves shorter and wider, widely patent, sheath wide with narrow pale membranous margins, narrowing to an incurved tip. *Cymes* 1 to several. *Spathes* with narrow, pale or reddish membranous margins, outer spathe 30–45 mm long, often somewhat spreading, with an acute, incurved tip, inner 50–65 mm long, erect. *Flowers* 50–80 mm long, sweetly almond or aniseed scented, greenish-white or pale greenish-yellow to pale greenish-blue. *Perianth cup* narrowly funnel-shaped, 17–20 mm deep, 10–12 mm diam. at the rim, with slits between the narrow claws; *nectaries* very small, green, at the base of the claws; *segments* with attenuate tips, margins slightly crisped and pale greenish-grey; outer segments 35–40 mm $\times$ 12–18 mm, striate with numerous short dark lines, inner segments narrower, 30–37 mm $\times$ 7–10 mm, not or faintly striate. *Filament tube* 12–20 mm long, pale, the free upper portion 2–4 mm long; *anthers* at first 5 mm long, later 3 mm, lobes at first parallel, later slightly divaricate at the bases, with yellow to orange-yellow pollen. *Ovary* 15–30 mm long, with a rostrum 8–20 mm; *style* 15–25 mm long, the branches 5–6 mm wide, flat, shallowly bifid, fimbriae pale, ca. 5 mm long; *stigmas* flattened, pale, bent over the anther tips. *Capsule* ellipsoid, 20–35 mm long, rostrate; *seeds* 3–4 mm diam., with a wrinkled, shiny brown testa.

Chromosome number: $2n = 20$.

Flowering period: June to September. The flowers remain open for 2–3 days.

Distribution: Throughout Namaqualand to Vanrhynsdorp and Clanwilliam, and from the coast to Nieuwoudtville and Pakhuis above the first escarpment, at altitudes up to 700 m. In stony, sandy, or gravelly ground.

CAPE—2816 (Oranjemund): Koeboes, Richtersveld (-BD), *Herre* STE 11861; Flats near Arrisdrift (-DA), *Marloth* 12391 (STE).

—2817 (Vioolsdrif): Richtersveld, *Marloth* 6758 (BOL).

—2917 (Springbok): Steinkopf na Kosies (-BA), *Verdoorn & Dyer* 1861 (PRE); Spektakel hill (-DA), *Barker* 7426 (NBG), *De Vos* 2330 (STE); 2 mls N of Springbok, (-DB), *Barker* 6250 (NBG); 8 km S of Springbok, v.d. *Walt*, sub *De Vos* 2300 (STE); Springbok, *Eliovson* 50 (PRE); Road Modderfontein-Pollyskloof (-DB/DC), *Van Heerden* 21 (BOL); In lapidosis prope Modderfontein (-DB), *H. Bolus* 6624 (BOL); Between Brakwater & Komaggas (-DC), *Hall* 159 (NBG); Voëlklip, rocky clefts (-DD), *Eliovson* 50 (PRE).

—3017 (Hondeklipbaai): Kamieskroon (-BB), *Marloth* 13268 (PRE), *Compton* 11110 (NBG); Skilpad near Grootvlei, *Lewis* 4993 (SAM), *Barker* 8619 (NBG);

Between Garies & Kamieskroon (-BD), *De Vos* 2327 (STE); 8 km NW of Garies (-DB), *Acocks* 19315 (PRE, K).

—3118 (Vanhynsdorp): Mierhofkasteel 12 km SW of Nuwerus (-AB), *Lewis* 2298 (SAM); Koekenaap-Nuwerus road opposite and N of Kliphoek Sta. (-AC), *De Vos* 2371, 2372 (STE); Holrivier (-AD), *Hall* 3730 (NBG); Between Knechtsvlakte & Sandveld, *Leipoldt* 4084 (BOL); 8 km N of Strandfontein (-CA), *De Vos* 2352 (STE); Farm Kliphoek 10 mls E of Doringbaai (-CD), *Hall* 3743 (NBG); Sandkraal (-DA), *Steyn* 435 (NBG); Between Vanhynsdorp & Klawer, *Lewis* 1991 (SAM); Ca. 3 km NW of Klawer towards Vredendal, *De Vos* 2340 (STE); Heerenlogement (-DC), *Esterhuysen* 5594 (BOL); Between Gifberg & Matsikamma, *Leipoldt* 4083 (BOL); Klawer, *Andreae* 401 (PRE); Between Clanwilliam & Klawer, *De Vos* 2346 (STE); The Krantz 6 mls out of Klawer, *Lewis* e.a. NBG 1859/32 (BOL, BM, K); 11 mls S of Klawer, *Lewis* 2299, SAM 60867 (PRE).

—3119 (Calvinia): Nieuwoudtville (-AC), *Ross-Frames* 19207 (BOL); Top Botterkloof Pass (-CB), *Lewis* 1992 (SAM); Between Doringriver & Botterkloof (-CD), *De Vos* 2370 (STE); Botterkloof, *Lewis* 2300 (SAM); Across Doringriver near Botterkloof, *Goldblatt* 432 (BOL).

—3218 (Clanwilliam): Clanwilliam (-AD), *Schlechter* 8597 (BM, K, PRE, Z), s.n. 21.8.96 (BOL); Between Langevallei & Heerenlogement (-BA), *Drège* s.n. (K, partly); De Lille, ft. of Nardouws Pass (-BB), *Van Breda* sub *De Vos* 2294 (STE); Biesiesfontein, *Leipoldt* BOL 20769; Langkraal, *Martin* NBG 1758/37, *Barker* 249 (NBG).

—3219 (Wuppertal): Pakhuis Pass (-AA), *Barker* 10454 (NBG); Pakhuis 2 km beyond turn-off to Bidouw, *De Vos* 2369 (STE); Mountain slopes above Welbedacht (-AB), *Lewis* 5225 (SAM).

Without precise locality: Namaqualand, *Scully* s.n. (K).

F. ferrariola is readily distinguished by its stem which is not completely covered with leaf sheaths, its red or purple spotted basal leaf sheaths, by its heterophylly, the lower leaves being suberect, long and narrow, and the upper ones short, widely spreading with wide sheaths narrowing to short incurved tips, and by pale flowers with the outer segments finely striate with short dark lines. The only species with which the species can be confused is *F. densepunctulata*, from which it differs in flower colouring, rostrate ovary, broadly flattened style branches, and red spotted lower leaf sheaths.

F. ferrariola has some features intermediate between sections *Ferraria* and *Macroscyphae*, such as anthers with lobes which divaricate late and only slightly. As the ovary is rostrate and the stigmas flattened, the species is placed with the latter section. Ker (1804) confused *F. ferrariola* with his *F. antherosa*, citing as synonym *F. viridis* Bot. Rep. t.285, which is an orthographical error for *F. viridiflora* Andrews, a superfluous name for *F. ferrariola*. His error led to the two species being repeatedly confused during the nineteenth century and later.

F. angustifolia Sw., an incompletely known species of which no type has been found, is described as having "very narrow subulate linear leaves and a greenish flower somewhat resembling *F. antherosa*". This is probably *F. ferrariola*, as the latter is widespread and is the only species then known with narrow leaves.

7. *Ferraria divaricata* Sweet, Brit. Flow. gdn. ser. 1, t.192 (1827). *Iconotype* l.c. t.192.

Plants 150–300(–400) mm tall. *Corm* irregular or depressed globose or almost cone-shaped but with a rounded top, 15–30 mm diam. *Stem* 60–200(–300) mm long, covered by leaf sheaths. *Cataphylls* 1–2, largely membranous. *Foliage leaves* numerous, suberect or spreading, distichous, 100–250(–400) mm long, (5–)7–12(–20) mm wide, with sheath as wide as, or slightly wider than the lamina which has an acute, obtuse or incurved, hooked tip, numerous closely spaced veins, rarely a slightly stronger midrib, and smooth margins. *Cymes* few to numerous. *Outer spathes* 35–40(–45) mm long, acute or subacute; inner 55–70(–90) mm long, with wide membranous margins, acute, subobtuse or with a hooded tip. *Flowers* 60–75(–80) mm long, with a sweet, or sharp unpleasant scent, yellow, green, bluish-green, orange-yellow or brown, often with a purplish-blue or greenish median blotch on each segment and sometimes with purplish or greenish spots, the margins concolorous or discolorous. *Perianth* with overlapping claws forming a bell-shaped cup 12–15 mm deep, 13–20 mm diam. at the rim; *nectaries* up to 4×2 mm, often bilobed or rarely 3-lobed, basal or a few mm above the bases of the inner claws; *segments* with concolorous, or brownish or greenish, crisped margins, limbs longer or sometimes shorter than the claws, with acuminate or slender, attenuate tip; outer segments $30\text{--}45\text{--}(50) \times 10\text{--}15\text{--}(20)$ mm, inner $27\text{--}40\text{--}(45) \times 6\text{--}10\text{--}(13)$ mm. *Filament tube* 10–12 mm long, the free upper portions (1.5–)2–4 mm long; *anthers* at first 5–6 mm long, later 2.5–4 mm, with widely divaricate lobes, pollen orange or yellow. *Ovary* 25–35(–60) mm long, with a rostrum 10–12 mm long; *style* 10–16 mm long, branches flat, widened to 4–6 mm, bifid, with dense tufts of pale or dark, often dendroid fimbriae ca. 5 mm long; *stigmas* slightly elongated, grooved, usually on the upper corners of the flat style branches, curved towards the anthers. *Capsule* long ellipsoid, $30\text{--}45\text{--}(50) \times 8\text{--}10$ mm, rostrate; *seeds* ca. 4 mm diam., pale brown to golden brown, wrinkled or sometimes finely reticulate or foveo-reticulate.

Chromosome numbers: $2n = 20, 40$, rarely 30, 50, 60.

Flowering period: End of July to October or November. The flowers remain open for one to two or sometimes three days.

Distribution: The most widely distributed species of *Ferraria* in the R.S.A., occurring from Namaqualand to the Cape Flats and the districts of Ceres, Worcester, Bredasdorp and Oudtshoorn, with outliers to the Great Karoo, southern Namibia and the Kalahari; in sand, sandy shale or gravel.

F. divaricata is a variable, aggregate species distinguished by its large flowers with large, widely divaricating anther lobes, flattened style branches and rostrate ovary. It is further distinguished from other members of section *Macroscyphae* by its perianth with a bell-shaped cup, wider segments and generally larger nectaries. Variation occurs in flower colouring, shape of perianth segments, size of nectaries, length of ovary rostrum, width of leaves, and also in chromosome numbers.

Ker's figure and description of *F. antherosa* in Curtis's Bot. Mag. t.751 (1804) are undoubtedly the present species. He cited as a synonym *F. viridis*, Bot. Rep. t.285 (an orthographic error for *F. viridiflora* Andrews, which proved to be a superfluous name for *F. ferrariola* (Jacq.) Willd.) The type (icono) of *F. viridiflora* is therefore included in *F. antherosa* and the latter epithet must be rejected as superfluous. Many workers of the nineteenth century, such as Aiton (1812), Roemer & Schultes (1817), Steudel (1840), Klatt (1895) and Baker (1877, 1892, 1896) also regarded the two species as identical, all except Baker treating *F. antherosa* as a synonym of *F. ferrariola*. But these two species are not conspecific, and the present species must therefore be given a legitimate name, which is *F. divaricata* Sweet.

Four subspecies are recognised which differ to some extent in geographical range, flowering period and chromosome numbers. Only slight morphological differences occur between the subspecies, such as the length of the free portion of the filaments, the form and colouring of the perianth, and the sculpture of the seed coat. Furthermore, these morphological differences are often difficult or impossible to observe in older herbarium material; thus some specimens cannot be allocated to the subspecies on morphological grounds, and the only criteria to use are the locality and the flowering period.

All four subspecies occur in the Vanrhynsdorp district, and this area can be considered the developmental centre of the subspecies. Subspecies *divaricata* which occurs from Namaqualand to Vanrhynsdorp, Clanwilliam and in the Karoo, is probably the original form from which the other subspecies are derived. These have spread to the south and south-east.

Evidence of hybridization between subspecies has been found in the form of a triploid (*De Vos* 2389) from the top of the Gifberg, Vanrhynsdorp, with leaves up to 20 mm wide. Subspecies *divaricata* (diploid) and subspecies *australis* (tetraploid) from which this hybrid probably originated, occur at the foot of the mountain.

KEY TO THE SUBSPECIES

- 1 Perianth bright golden yellow; limbs with concolorous margins c. subsp. **aurea**
- 1 Perianth greenish-yellow, bluish-green, yellow-brown to brown; limbs usually with discolorous margins.
- 2 Outer perianth segments usually without spots; free upper portion of filaments usually longer than 2.5 mm; diploids.
- 3 Leaves erect or suberect; flowers largely brown; flowering period (September-) October-November; in deep sand in coastal districts from Strandfontein to Bellville b. subsp. **arenosa**

- 3 Leaves usually spreading, rarely suberect; flowers greenish-yellow to brownish-yellow or bluish-green, the segments usually with a diffuse bluish median zone; flowering period August to September; in gravel or sand, from Namaqualand to Clanwilliam, the Karoo and Kalahari a. subsp. **divaricata**
 2 Outer perianth segments usually with small spots; free upper portion of filaments usually less than 2,5 mm long; polyploids d. subsp. **australis**

a. subspecies **divaricata**

F. divaricata Sweet, Brit. Flow. gdn. ser. 1 t.192 (1827), *iconotype*; Klatt, in Linnaea **34**: 625 (1865–66) & in Abh. Naturf. Ges. Halle **15**: 387 (1882) & in Dur. & Schinz, Consp. Fl. Afr. **5**: 156 (1895); Bak., in J. Linn. Soc. Bot. **16**: 106 (1877) & Hdb. Irid.: 73 (1892) & in Fl. Cap. **6**: 30 (1896).

F. antherosa Ker, in Curtis's Bot. Mag. **20**: 751 (1804), as to description and figure but not to synonym, nom. illeg. (nom. superfl.), & in Kon. & Sims, Ann. Bot. **1**: 242 pro parte (1805); Bak., Hdb. Irid.: 72 (1892) excl. syn. & in Fl. Cap. **6**: 29 (1896) excl. syn.; Pole Evans, in Flow. Pl. S. Afr. **2**: 66 (1922).

Icones: Curtis's Bot. Mag. **20** t.751 (1804); Sweet, Brit. Flow. gdn. ser. 1, t.192 (1827); Flow. Pl. S. Afr. **2** t.66 (1922).

Lower foliage leaves spreading or sometimes suberect, 4–20 mm wide. *Perianth* greenish-yellow, bluish-green or brownish-yellow, the limbs usually with a bluish or purplish median zone, usually without spots, longer to shorter than the claws, tips usually attenuate; nectaries to 3–4 mm long, basal on the outer claws, and basal or up to 3 mm above the inner claw bases. *Filaments* with the upper free portions (2,5–)3–4 mm long. *Seeds* with a rather dull wrinkled testa.

Chromosome number: $2n = 20$.

Flowering period: August to end of September. The flowers remain open for one to two days.

Distribution: Widely distributed from southern Namibia through Namaqualand to Clanwilliam, in the Karoo and the Kalahari; in sand or shale.

NAMIBIA—2716 (Witputs): Namuskluft (-DD) *Giess 12900* (M, PRE, WIND).

CAPE—2817 (Vioolsdrift): 15 km S of Vioolsdrift (-DC) *Giess 14535* (PRE).
 —2820 (Kakamas): Aries (-AA), *Barnard SAM 36065*.

—2821 (Upington): Upington sandveld (-AC), *Mostert 1415* (PRE).

—2822 (Glenlyon): 21 mls SW of Olifantshoek (-BA), *Leistner 2787* (KMG); Langberg, Hay (-DD?), *Hunter 18* (PRE); Doringaar, Hay, *Acocks 571* (PRE, KMG).

—2917 (Springbok): Steinkopf, Kasteelpoort (-BC), *Herre STE(BG) 493* (BOL); Koufontein, nr. Steinkopf, *Herre STE(BG) 3009* (BOL); 21 mls N of Springbok (-BD), *Mauve 4173* (PRE); Steinkopf, *Lewis 5496* (NBG); 25 mls from Okiep on Goodhouse road, *Lewis 5522* (NBG); Between Ratelpoort and Okiep (-BD-DB), *Lewis 5502* (NBG); Between Springbok and Steinkopf, *Van der Schijff 8250* (PRE); Buffels River kloof (-CB-DA), *Lewis 1373* (SAM); !Us se sand (-DA),

Herre STE 11325; Nigramoep, *Wikner* SAM 62780; W foot of Spektakel Pass, *De Vos* 2331 (STE); 28 mls W of Springbok after Spektakelberg, *Thompson* 1049 (STE); Between Brakwater and Komaggas (-DC), *Hall* 158 (NBG); Between Komaggas and Soebatsfontein, *Barker* 6746 (NBG); Komaggas, *Herre* Fl. Hort. S.U.G. 488 (BOL); Between Springbok and Bowesdorp (-DD), *De Vos* 2329b (STE).

—2918 (Gamoep): Near Ratelkraal (-CA), *Barker* 6757 (NBG).

—2919 (Pofadder): Roadside Pofadder to Springbok 6 km (-AB), *Boucher* 2886 (STE).

—2921 (Kenhardt): Kenhardt golf course (-AC), *De Vos* 2395 (STE); Kenhardt, *Van Niekerk* STE 8815.

—3017 (Hondeklipbaai): Soebatsfontein (-BA), *Barker* 3708, 6746 (NBG).

—3018 (Kamiesberg): Stinkfontein, in collibus (-CC), *Schlechter* 11096 sub *F. plumosa* Schlecht. ined. (B, BM, BR, K, S).

—3022 (Carnarvon): Buffelsbout in Central Karoo (-AD), *Burchell* 1599 (K) pro parte, sub *F. atrata* Lod.

—3023 (Britstown): Britstown (-DA), *Mauve* 4133 (PRE).

—3118 (Vanhynsdorp): 2 km on Kliprand rd. E of Nuwerus (-AB), *Hugo* 461 (STE); Between Klawer and Vanhynsdorp (-DA), *Bolus* BOL 23194; Sanddunes 3–4 mls N of Klawer station, *Leipoldt* 4166 (BOL); Vanhynsdorp, *Rood* PRE 1471; 8 km N of Vanhynsdorp, *De Vos* 2332 (STE); 12 km E of Vredendal, *Hall* 3670 (NBG); Gifberg, mountain path from Windhoek, *Phillips* 7760 (NBG); Windhoekwerf onder Gifberg, *De Vos* 2358 (STE); Flats W of Matsikamma (-DB), *Oliver* 4993 (STE); Urionskraal, *Barker* 8581 (NBG); Near foot of Tigerberg about 15 mls E of Vanhynsdorp, *Lewis* 4430 (SAM); Sandkraal, Vanhynsdorp, *Steyn* 432 (NBG); Klawer (-DC), *Maguire* 943 (NBG), *Bolus & Lewis* BOL 31243; Salt River bridge, Vanhynsdorp (-BC), *Acocks* 16432 (PRE).

—3119 (Calvinia): Near Nieuwoudtville (-AC), *Acocks* 14712 (PRE); Nieuwoudtville, *Bolus* BOL 19574; Near river on way to Grasberg, near Nieuwoudtville, *Bolus* BOL 19349; Nieuwoudtville, Klipkoppies lower slopes, *Barker* 9537 (NBG); Between Nieuwoudtville and Oorlogskloof (-AC/D), *Leipoldt* 3841 (BOL); Kareekom, c. 25 mls N by W of Calvinia (-BA), *Leistner* 466 (PRE); Calvinia (-BD), *Schmidt* 135 (PRE); Boklandskloof (Lokenberg N) (-CA), *Acocks* 19736 (NBG); Koedemoefontein near Botterkloof Pass (-CD), *Oliver* sub *De Vos* 2353 (STE); Kareeboomfontein (-DA), *Hanekom* 2412 (PRE).

—3218 (Clanwilliam): Clanwilliam, sandy hill slope (-BB), *Galpin* 10517 (PRE); On the Olifants River and at Villa Brakfontein, 76 (-DB), *Ecklon & Zeyher* s.n. (PRE, Z), PRE 22381.

—3219 (Wuppertal): Pakhuis, 5 km from turnoff towards Bidouw (-AA), *De Vos* 2348 (STE); Bidouw valley (-AB), *Middlemost* 1746 (BOL, NBG); Welbedacht, Bidouw River valley, *Lewis* 2665 (SAM); Matjiesriver, Cedarberg (-AC), *Wagener* 198 (NBG).

This subspecies is distinguished by its usually spreading leaves, perianth segments of diverse shades but not golden yellow, usually without spots, often with a diffuse bluish or purplish median zone above the claws, limbs usually longer than the claws, and by the free portions of the filaments usually more than 2.5 mm long.

Collections from Namaqualand, such as *Herre* sub STE 11325, *Hall* 158 (NBG), *Barker* 6757 (NBG), *Lewis* 5522 (NBG), *Rösch & Le Roux* 583 (PRE), *Giess* 14535 (PRE), etc., differ in their longer, narrow (ca. 4–5 mm wide) linear lower foliage leaves.

Compton 5405 from Wallekraal, Namaqualand (in NBG, but not BOL) comprises two unusual specimens with narrow, spirally twisted leaves. It is nearest this species.

Plants from the Karoo and Kalahari vary somewhat from those of the western districts: they often have glaucous suberect leaves up to 300 mm long and the flowers have very dense tufts of fimbriae; their colour has been recorded as "dark purple, tips of lobes dirty yellow" and "dark grey brown". Specimens from Kenhardt (*De Vos* 2395) show a large purple blotch on each perianth lobe, with the upper part of the lobe brownish-orange. Baker (1892, 1896) misidentified *Burchell* 1599 from Buffelsbout in the Central Karoo, as *F. atrata* Lod., a species with an inadequate description and an incorrectly drawn figure in which the stamens and style fit no species of *Ferraria*. (Loddiges's plant was brought from the Cape by Mr Synnot and is not Burchell's specimen.)

b. subspecies **arenosa** De Vos, subsp. nov.

F. divaricata subsp. *divaricata* affinis sed solum arenaria, foliis suberectis, perigonio brunneo vel fulvo differt.

Type: Cape, Vanrhynsdorp, De Lille, Nardouwspas, *Van Breda* sub *De Vos* 2295 (STE, holo.).

Leaves suberect, slightly glaucous. *Perianth* largely brown, purplish-brown, or yellowish-brown, without spots, with limbs shorter to slightly longer than the claws, with acuminate or attenuate tips; *nectaries* to 3 mm long, basal and sometimes 3-lobed on the outer claws and 1–3 mm above the bases of the inner claws. *Filaments* with the free upper portions 3(–4) mm long. *Seeds* dull, brown or golden brown, finely reticulate-foveolate.

Chromosome number: $2n = 20$.

Flowering period: October to November, rarely in September. The flowers remain open for one day only.

Distribution: Western coastal districts from southern Namaqualand to the Cape flats; in deep coastal sand.

CAPE—3017 (Hondeklipbaai): Road to Hondeklipbaai (–AD), *De Vos* 2402 (STE).

—3118 (Vanrhynsdorp): Ca. 16 km NO of Strandfontein (–CA), *De Vos* 2356

(STE); 1 ml NW of Vredendal (-CB), *Van der Merwe* 152 (STE); Between Klawer and Vanrhynsdorp (-DA-C), *Watermeyer* NBG 1951/30 (BOL); De Lille, Nardouwspas (-DD), *Van Breda* sub *De Vos* 2295 (STE).

—3217 (Vredenburg): N van Saldanhabaai (-DD), *De Vos* 76/15.

—3218 (Clanwilliam): Nortier proefplaas, Lamberts Bay (-AB), *Van Breda* sub *De Vos* 2341 (STE); Verlorelei, N edge near Redelinghuis (-AD), *Pillans* 8123 (BOL); Sandy slopes between Verlorelei and Rooikransberg, *Pillans* 8124 (BOL); Between Clanwilliam and Citrusdal (-BD), *De Vos* 2361 (STE); Eendekuil (-DB), *Strey* s.n. 2.10.46 (M).

—3318 (Cape Town): Langebaan (-AA), *L. Bolus* NBG 3184/32 sub *F. langebaanensis* L. Bol., ined. (BOL, K); Churchhaven, *Lewis* s.n. (BOL); On road to Gansekraal (-AD), *Barker* 730 (NBG); Silverstream Strand (-CB), *De Vos* 2339 (STE); University of Western Cape, Bellville (-DC), *Delpierre* sub *De Vos* 2385 (STE).

This subspecies is best distinguished by its erect habit, brown flowers, late flowering period and by its habitat in deep sand.

As indicated on certain specimens in the Bolus herbarium, L. Bolus intended to describe this as a distinct species, *F. langebaanensis*, but the name was not published.

c. subspecies **aurea** De Vos, subsp. nov.

Ferraria divaricata subsp. *arenosa* et subsp. *divaricata* affinis a qua differt floribus aureis fere concoloribus, limbis perigonii horizontaliter patentibus, solum in partibus superioribus recurvis, unguis aequantibus vel eis brevioribus.

Type: Cape, Clanwilliam, Langdam, *De Vos* 2297 (STE, holo.).

Leaves suberect, slight glaucous. *Flowers* with a sweetish scent, bright golden yellow (RHS 5A, 12A, 14A), the perianth segments with concolorous margins, the limbs with a diffuse greenish median zone or greenish dots above the claws, equal to or shorter than the claws, horizontally spreading and with only the upper one quarter recurved, tips acuminate or shortly attenuate; *nectaries* usually small, almost hidden near the bases of the claws. *Filaments* free for (2,5–)3–4 mm above the filament tube. *Seeds* almost globose with a rather dull, light brown, reticulate-foveolate testa.

Chromosome number: $2n = 20$.

Flowering period: September to end of October. The flowers remain open for one day only.

Distribution: From Namaqualand to Clanwilliam.

CAPE—3017 (Hondeklipbaai): Between Hondeklipbaai and Wallekraal (-AD), *Lewis* NBG 2052/32 (BOL).

—3118 (Vanrhynsdorp): Between Papendorp and Doringbaai (-CA), *De Vos* 2384

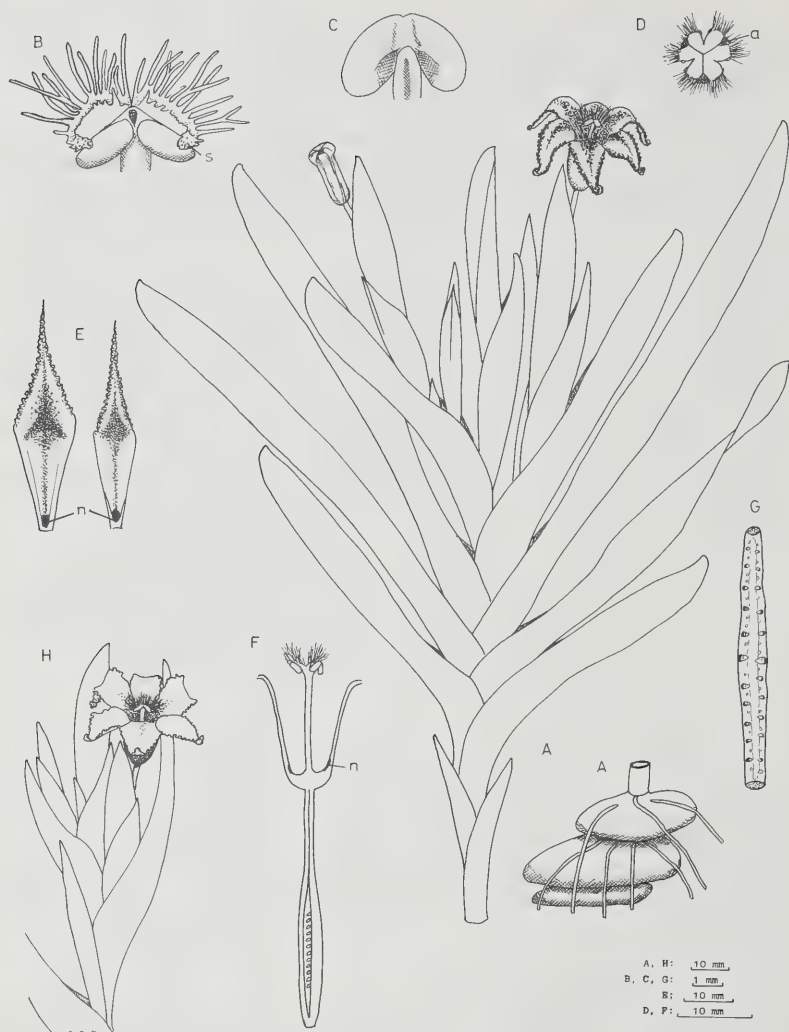


FIG. 23.

Ferraria divaricata, A-G subsp. *australis*. A, plant; B, one style branch and anther, side view; C, anther and free part of filament, adaxial side; D, style branches seen from above; E, outer (left) and inner (right) perianth segments; F, base of flower, longitudinal view; G, transverse section of leaf blade. H, subsp. *aurea*, flowering branch; a, anther; n, nectary; s, stigma.

(STE); Ca. 3 km NW of Klawer towards Vredendal (-DA), *De Vos* 2333 (STE). —3218 (Clanwilliam): Langdam, ca. 15 km E of Lamberts Bay (-AB), *De Vos* 2297 (STE).

In the living state this subspecies is readily distinguished by its bright yellow, almost concolorous flowers with short perianth limbs. In herbarium specimens the colour has usually faded and some of the older herbarium material without dissected flowers, which have now been placed under *F. divaricata* subsp. *divaricata* or subsp. *arenosa*, may perhaps be subspecies *aurea*; such is *Acocks* 16432 in PRE from 3118–BC, in which the flower colour is recorded as orange.

d. subspecies **australis** De Vos, subsp. nov.

Haec subspecies nova ab aliis subspeciebus *Ferrariae divaricatae* distinguitur numero chromosomatum polyploideo, segmentis exterioribus perianthii plerumque maculatis, partibus liberis superioribus filamentorum 1,5–2(–2,5) mm longis, seminibus nitidis cinnamomeis, irregulariter angulatis.

Type: Cape, Montagu, Whitehill Karoo Garden, *Compton* 17412 (NBG, holo.).

Leaves spreading or sometimes suberect. *Flowers* with a sharp unpleasant scent. *Perianth* greenish-yellow, orange-brown or purplish-brown, with olive-green, orange-brown or dark brown margins, the outer segments usually with a greenish-blue or brownish median zone and with small brown, purple or green spots above the claws; limbs longer than the claws, tapering to long slender attenuate tips; *nectaries* as in subsp. *divaricata*. *Filaments* with their free upper portions 1,5–2(–2,5) mm long. *Seeds* shiny golden brown, angled by pressure, the testa irregularly wrinkled.

Chromosome number: $2n = 40$.

Flowering period: August to October. The flowers remain open for two or sometimes three days.

Distribution: From Vanrhynsdorp southwards to the inland districts of Ceres, Worcester, Montagu and Oudtshoorn, and the south coast district of Bredasdorp (hence the epithet); in sandy shale or clayey ground.

CAPE—3118 (Vanrhynsdorp): Lutzville-Vredendal (-CB), *De Vos* 2373 (STE); Between Vanrhynsdorp and Vredendal (-DA), *De Vos* 2367 (STE). —3319 (Worcester): Cold Bokkeveld (-AB), *Alston* SAM 10784; Romansriver, Mostertshoek (-AC), *Mostert* sub *De Vos* 2290, 2314 (STE); Mitchell's Pass (-AD), *Guthrie* 3401 (SAM); Flats E of Prince Alfred's Hamlet, *Oliver* 5062 (STE, S); Rhodona, Ceres Karoo, *Cillié* sub *De Vos* 2334, 2335 (STE); Karoopoort (-BA), *Kirstenbosch Exped.* NBG 408/44; Ceres Karoo (-BB), *Marloth* 5296 (BOL, PRE); Osplaas sta. NE of De Doorns (-BC), *Mauve & Oliver* 125 (PRE, STE); Hex River Pass, *Leighton* 3173 (BOL); Between Karoopoort and

Ceres, *Dymond* BOL 21236; In convalle flum. Hex prope De Doorns, *H. Bolus* 13060 (BOL); Bainskloof E end (-CA), *Gillett* 1723 (STE); Veldreservaat, Worcester (-CB), *Olivier* 187 (STE, PRE); Worcester, *Van Breda* 49 (PRE); Sandy flats near Brandvlei, *Lewis* 6049 (NBG); Between Franschhoek and Villiersdorp (-CC-D), *Lewis* 2895 (SAM); Doorn River 12 mls from Villiersdorp (-CD), *De Villiers* s.n. 25.10.62 (NBG); Near Mowers station (-DA), *De Vos* 2299 (STE); Karookoppies SE of De Wet station, *Oliver* 5029 (STE); 8 mls from Robertson to McGregor (-DD), *Marsh* 974 (PRE, STE).

—3320 (Montagu): Tweedside (-AB), *Barker* 7463 (NBG), *Marloth* 10807 (PRE); Whitehill Karoo Garden (-BA), *Compton* 7631, 5590, 13931, 14857, 17412 (NBG); 3 mls N of Matjiesfontein, *Acocks* 17163 (PRE); Matjiesfontein-Laingsburg (-BA-B), *Moffett* 713 (STE); Near Ashton (-CC), *Barker* 1978 (NBG); Bonnievale, *Dymond* NBG 1940/33 (BOL, PRE, K).

—3321 (Ladismith): Naby Muiskraal, N van Garciaspas (-CC), *Moffett* sub *De Vos* 2403 (STE).

—3322 (Oudtshoorn): Meiringspoort (-BC), *Goldblatt* sub *De Vos* 2337 (STE); 9 mls W of Oudtshoorn towards Calitzdorp (-CA), *Zinn* SAM 65672.

—3419 (Caledon): E of Kleinmond (-AC), *Vlok* sub *De Vos* 2380 (STE).

—3420 (Bredasdorp): Stormsvlei kloof (-AA), *Lewis* 1603 (SAM); Korlandskloof W of Stormsvlei, *Oliver* 6025 (STE); Bontebokpark (-AB), *Marais* s.n. (STE); 20 mls W of Swellendam, *Goldblatt* 453 (BOL); Aerodrome near Bredasdorp (-CA), *Keast* s.n. 18.9.51 (NBG).

Herbarium specimens of this subspecies can best be distinguished by their localities, by filaments with the free portions very short, and shiny seeds angled by pressure.

The specimen *H. Bolus* 9982 in BOL, (in salo argillaceo in apertis prope Moorreesburg) is probably this subspecies. If this is so, this locality (Cape Town 3318, BA/B) is the nearest that this subspecies has spread to the Cape Peninsula.

Evidence of hybridization between this subspecies and *F. crispa* has been found in, firstly a specimen collected by *Oliver* sub *De Vos* 2407 on the top of Hex River Pass near Touwsrivier (3318-BD) which is a pentaploid ($2n = 50$). This has a brown perianth with a bluish-purple median zone and small dark spots on each limb; the ovary has only a short rostrum, but the anthers and stigmas resemble *F. divaricata*. Secondly, on the farm Kleiheuvel, Bredasdorp district (3420-CA), plants occur (*De Vos* 2405, 2381) with characters intermediate between the present subspecies and *F. crispa*, the perianth resembling that of the latter species and the anthers and stigmas that of *F. divaricata*. These plants are, however, hexaploids with $2n = ca. 60$. How they originated, is impossible to say.

8. *Ferraria kamiesbergensis* De Vos, spec. nov.

Calvis 50–200(–500) mm longus, plerumque vaginis foliorum obtectus. *Folia* 100–250(–500) mm longa, 5–12 mm lata, apicibus plerumque minute cuculatis

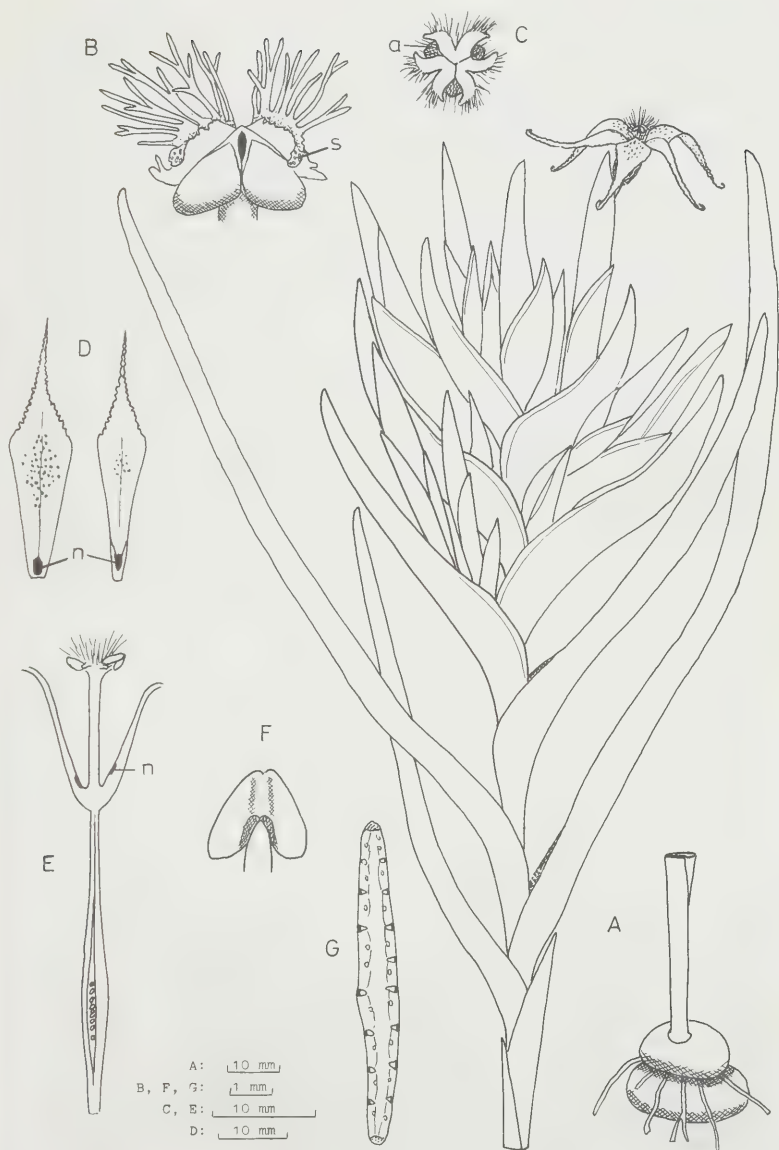


FIG. 24.

Ferraria kamiesbergensis. A, plant; B, one style branch and anther, side view; C, style branches and anthers, top view; D, outer (left) and inner (right) perianth segments; E, base of flower, longitudinal view; F, anther and free part of filament, adaxial side; G, transverse section of leaf blade; a, anther; n, nectary; s, stigma.

vel incurvatis vel acutis. *Cymae* paucae vel plurimae. *Spathae* marginibus membranaceis angustis, spatha exterior (25–)30–45 mm longa, interior 50–65 mm longa. *Flores* 45–60 mm longi, leviter odorati, cremei vel flavidi vel e cinereo virides, viridi- vel cinereo-punctulati. *Perigonium* unguibus imbricatis, cupulam anguste infundibularem 8–12 mm longam facientibus, nectariis minutis, bases unguium positis; *segmenta* apicibus longis tenuibus attenuatis, segmenta exteriora 6–9 mm lata, interiora 4–7 mm lata. *Tubus filamentorum* 8–10(–12) mm longus, partibus liberis, 1.5–2 mm longis; *antherae* horizontales, thecae divaricatae. *Ovarium* 18–30 mm longum, rostro gracile praeditum; *stylus* 8–12 mm longus, ramis e basi dilatatis, complanatis, bifidis, fimbriis ad 3 mm longis; *stigmata* ut in *F. uncinata*. *Capsula* ellipsoidea, ca. 30 mm longa, rostrata. Chromosomatum numerus $2n = 20$.

Type: Cape, Kamiesberg, Rondefontein, Oliver 5970 (STE, holo.).

Plants, 100–300(–500) mm tall. *Corm* ca. 15–30 mm diam., irregular and oblique or almost discoidal. *Stem* 50–200(–500) mm long, covered or rarely partly covered by leaf sheaths. *Cataphylls* 1–2. *Foliage leaves* several, 100–250(–500) mm long, 5–12 mm wide, tip minutely hooked, incurved or acute. *Cymes* few to numerous. *Spathes* with narrow pale membranous margins, outer spathe (25–)30–45 mm long, inner 50–65 mm. *Flowers* 45–60 mm long, faintly and pleasantly scented, cream to pale yellow or pale greyish-green, often with minute dark green or grey spots above the claws, and with darker yellow or brownish-green, slightly crisped tepal margins. *Perianth* with overlapping claws forming a narrowly funnel-shaped cup 8–12 mm deep and 6–10 mm diam. at the rim; *nectaries* minute, basal on the outer claws and almost basal in a groove on the inner claws; *segments* with long, slender, attenuate tips, outer segments $25\text{--}32 \times 6\text{--}9$ mm, inner $22\text{--}30 \times 4\text{--}7$ mm. *Filament tube* 8–10(–12) mm long, pale, the free upper portions 1.5–2 mm long; *anthers* horizontal, at first 3.5 mm long, later less than 2 mm, with widely divaricate lobes, dark purple or pale; pollen orange or yellow. *Ovary* 18–30 mm long, with a rostrum 8–18 mm long; *style* 8–12 mm long, the branches flat, 3–4 mm wide, bifid, with fimbriae to 3 mm long, pale towards the tips; *stigmas* as in *F. uncinata*. *Capsule* ellipsoid, ca. 30 mm long, rostrate.

Chromosome number: $2n = 20$.

Flowering period: End of August to October. A flower remains open for one to two days.

Distribution: Sparsely distributed in Namaqualand south of Springbok, on Kamiesberge, and in the western Karoo; in sand or sandy ground.

CAPE—2917 (Springbok): Flats S of Populiersberg S of Springbok (-DB), Thompson 1301 (STE).

—3017 (Hondeklipbaai): Wallekraal (-BC), Compton 5405 pro parte (BOL,

possibly not in NBG); 38 km from Garies to Wallekraal, *Dryfhout* sub *De Vos* 2399 (STE).

—3018 (Kamiesberg): De Kom, 3 mls from Leliefontein (-AB), *Leipoldt* 3563 (BOL); Wilgenhout Ravine (-AC), *P. Sladen Mem. Exp.* 6812 (BOL); Southern Kamiesberg, Rondefontein S of Nartjiesdam (-CA), *Oliver* 5970 (STE).

—3019 (Loeriesfontein): Onderste Camdini on road between Kliprand and Loeriesfontein (-CC), *Thompson* 2882 (STE).

—3119 (Calvinia): Near Hantamsriver 30 mls NW of Calvinia on Loeriesfontein road (-AB), *Lewis* SAM 61921 (BOL), 2534 (SAM); Loeriesfontein road 32 mls from Calvinia, *Johnson* 603 (NBG); 29 km from Loeriesfontein towards Calvinia, *De Vos* 2347 (STE); 17 mls along Klipwerf road from Calvinia-Williston road (-BB), *Hiemstra* 622 (NBG).

This species is distinguished by a pale yellow or sometimes pale greyish-green flower resembling that of *F. uncinata* subspecies *macrochlamys* and *F. brevifolia*, with its long, narrow, attenuate perianth segments, small divaricate anthers and rostrate ovary; and further by long linear leaf blades with smooth margins. It is intermediate between *F. uncinata* and *F. divaricata*, differing from the former in its smooth leaf margins and flowers usually with a slightly shallower perianth cup. It differs from *F. divaricata* in its smaller, pale flowers with narrower perianth cup and segments, and minute nectaries.

The specific epithet has been chosen as this is one of the few species of *Ferraria* found on the Kamiesberge.

9. *Ferraria uncinata* Sweet, Flow. gdn. ser. 1, sub t.161 (1826). *Iconotype*: l.c. t.161.

Plants 100–250(–400) mm tall. *Corm* almost symmetrical, somewhat discoidal or with the top surface almost flat, to 35 mm diam. and 15 mm high. *Stem* 50–150(–300) mm long, covered with leaf sheaths. *Cataphylls* 1–2, pale. *Foliage leaves* several, suberect or spreading, often somewhat falcate, 80–200 × (3–)5–10(–18) mm, with finely crisped or irregularly toothed margins, obtuse or with hooked incurved tip, with sheaths as wide as, or slightly wider than the leaf blades. *Cymes* several. *Spathes* with narrow, pale, membranous margins and incurved tips, outer spathe (25–)30–40(–50) mm long, inner (35–)50–60 mm. *Flowers* (30–)45–60 mm long, faintly and pleasantly scented, pale yellow, blue or purplish-blue with narrow or wide, greenish or yellowish segment margins. *Perianth* with overlapping claws forming a narrowly funnel-shaped cup 10–12 (–14) mm deep, 6–9 mm diam. at the rim; *nectaries* minute, basal, or sometimes subbasal on the inner claws; *segments* with long, slender, attenuate tips and finely crisped, often discolorous margins, outer segments 30–40 mm × 6–10 mm, sometimes sparsely dotted above the claws, inner 25–35 mm × 4–7(–9) mm. *Filament tube* 8–12 mm long with the free upper portions less than 2 mm long; *anthers* horizontal, at first 3 mm long, later less than 2 mm, with widely divaricate

lobes and yellow or orange pollen. *Ovary* (15-)20-25(-40) mm long with a rostrum (5-)8-15(-20) mm long; *style* 10-15 mm long, branches flattened, 3-4 mm wide, bifid, with fimbriae 2-4 long; *stigmas* ca. 1 mm, grooved, curved towards the anther lobes. *Capsule* ellipsoid, ca. 20-25 mm long, rostrate; *seeds* ca. 3 mm diam. with shiny brown testa.

Chromosome number: $2n = 20$.

Flowering period: August to October, rarely to November. A flower remains open for two to three days.

Distribution: From Springbok to Garies and from Clanwilliam to Malmesbury, in sandy shale or somewhat clayey ground.

This species is readily distinguished by its leaves, most, or some of which have finely crisped, irregularly toothed, or somewhat wavy margins. It stands nearest *F. kamiesbergensis*, its flower resembling that of this species in shape and sometimes in colour, and in its small anthers with widely divaricate lobes, its rostrate ovary and flattened style branches.

It differs from *F. divaricata* in its crisped leaf margins, its smaller, differently coloured perianth with a narrower funnel-shaped cup and narrower segments, and in its smaller anthers. A collection, *Compton 13896* from the Mamre hills, Malmesbury, has foliage leaves showing a slight crispulation and flowers resembling those of *F. divaricata*; it may represent a hybrid between the two species.

Two subspecies, previously considered to be distinct species, are recognised. They differ only in flower colouring and geographic distribution, being separated by the Knersvlakte of Vanrhynsdorp where no *Ferraria* species has been found to occur.

The iconotype, Sweet t.161, does not show crisped leaf margins. The flower depicted is, however, so typical, that there can be no doubt what species is figured as *F. uncinata*. (Crispulation sometimes occurs in this species on only a few of the leaves and could therefore have been overlooked.)

KEY TO THE SUBSPECIES

- Perianth segments blue with narrow yellowish-green margins, or with a purplish-blue median zone and wide yellowish margins; south of Vanrhynsdorpa. subsp. **uncinata**
 Perianth segments pale yellow, often with slightly darker yellow margins; north of Vanrhynsdorpb. subsp. **macrochlamys**

a. subspecies **uncinata**

Ferraria uncinata Sweet, Brit. Flow. gdn. ser. 1 t.161 (1826), *iconotype*; Klatt, in Dur. & Schinz, Consp. Fl. Afr. 5: 156 (1895).

F. framesii L. Bol., in J. Bot. Lond. 71: 123 (1933). *Type*: Cape, Clanwilliam, hill about 6 mls south of Clanwilliam, *Ross Frames* BOL 19928 (BOL, holo.; SAM, iso.).

F. ferrariola sensu Eckl., Top. Verz.: 18 (1827), non (Jacq.) Willd. (1800), nec. Roemer & Schultes (1817), nec. Klatt (1895).

Icones: Sweet l.c.; Rice & Compton 1950 Pl. 187 f. 3 sub *F. antherosa*; Mason 1972 Pl. 25 f. 1; this work Figs 25 A–G, 13B.

Leaves suberect or spreading, 80–200 mm × 8–15(–18) mm, some (or rarely all) with irregular, finely toothed or crisped margins. *Perianth segments* bright to dark blue (RHS 90A, 93B, 103A, B), with narrow, green or greenish-yellow margins, or with a purplish-blue median zone and wide yellowish margins, the outer segments sometimes with purplish-blue dots above the claws.

Distribution: Mostly below the first escarpment from Clanwilliam to Malmesbury.

CAPE—3118 (Vanrhynsdorp): Gifberg (-DC), *Leipoldt* 4081 (BOL); Nardouw kloof (-DD), *Stokoe* SAM 59836.

—3218 (Clanwilliam): Zwischen Langevalei u. Heerenlogement (-AB), *Drège s.n.* Juli (S, partly); Elands Bay (-AD), *Leighton* 192 (BOL); Ramskop (-BB), *Leipoldt* 1049 (BOL), *De Vos* 2363 (STE); Clanwilliam, *Schlechter* 8413 (PRE, partly in BM, K, S); 2 mls S of Clanwilliam, roadside, *Marsh* 766 (STE); Next to Olifants River 5 km from Clanwilliam to Klawer, *Mauve & Oliver* 104 (PRE, STE); Prope Olifants River, Clanwilliam, *Pappe* SAM 70648; Olifants River valley near Nardouw road, *Lewis* 1349 (SAM); Nardouw road turn-off, *Lewis* 5213 (NBG); The Weir, Olifants River valley, *Lewis s.n.* 5 Sept. 1932 (BOL); Eastern banks of lower Clanwilliam dam, *Hugo* 443 (STE); Near dam, *Lewis* 1868 (SAM), *Van Breda* 4285 (STE); Hill about 6 mls S of Clanwilliam (-BD), *Ross-Frames* BOL 19928 (BOL, SAM); 15 mls N of Citrusdal, *Hall* 546 (NBG); Roadside Clanwilliam-Citrusdal, *De Vos* 2359 (STE); ½ km from N11 towards Algeria, *De Vos* 2377, 2398 (STE); Ca. 8 km N of Citrusdal, *De Vos* 2362 (STE); Aurora (-CB), *Loubser* 2180 (BOL); Berg Valley (-DA), *Lewis* 1867 (SAM); Het Kruis, *Thorne* SAM 52922, *P. Sladen Mem. Exp.* 8616 (K), *Compton* 15026 (NBG); Boskloof, Clanwilliam-Piketberg, *Compton* 9528 (NBG); 4 mls S of Piketberg (-DC), *Lewis* BOL 22259; Near The Rest (-DB), *Bolus s.n.* (BOL); Bergrivier bridge near Piketberg (-DC), *De Vos* 2325 (STE); Piketberg mountain, *Gentry e.a.* 18628 (PRE).

—3219 (Wuppertal): Brandewynsrivier E of Pakhuis Pass (-AA), *Lewis* 2297 SAM 60865 (PRE), BOL 22258, *Barker* 6572 (NBG); Near Porterville in the pass (-CC), *Leipoldt* 3842 (BOL).

—3318 (Cape Town): Hopefield (-AB), *Marloth* 8905 (PRE); 8 mls S of Hopefield, *Salter* 3900 (BOL); Darling Flora Reserve (-AD), *Lewis* 5075, 5745 (NBG), *Barker* 8658 (NBG); Moorreesburg (-BA), *Marloth* 11487 (PRE); Twenty-four Rivers, Porterville (-BB), *Immelman* NBG 1995/28 (BOL); Twenty-four Streams near Saron, *Lewis* BOL 31216; Prope Grünekloof (-CB), *Ecklon* UJ305 (K, M, S); Kalbaskraal (-DA), *Srey s.n.* 5.10.46 (M).

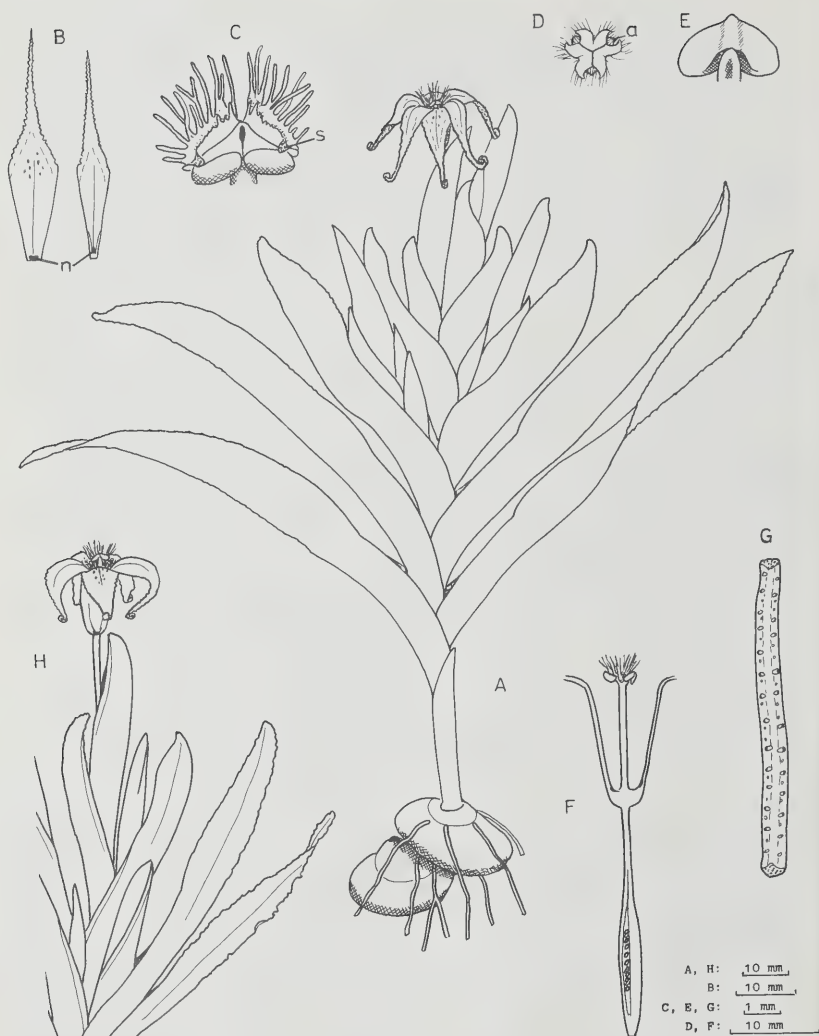


FIG. 25.

Ferraria uncinata, A-G subsp. *uncinata*. A, plant; B, outer (left) and inner (right) perianth segments; C, one style branch and anther, lateral view; D, style branches, top view; E, anther and free part of filament, adaxial side; F, base of flower, longitudinal view; G, transverse section of leaf blade. H, subsp. *macrochlamys*, part of plant; a, anther; n, nectary; s, stigma.

—3319 (Worcester): De Hoek estate near Saron (-AA), *Compton* NBG 1859/36, *Lewis* NBG 1859/36 (BOL); Saron, *Strey* s.n. 29.9.46 (M); Mostertshoek, Romansrivier (-AC), *De Vos* 2338 (STE).

Two collections from 3218-BB differ from the typical in flower colouring: those of *Mauve & Oliver* 104 in PRE and STE have yellow flowers with a narrow purplish median zone, and that of *Hugo* 443 in STE has flowers "brownish gold spotted green".

b. subspecies **macrochlamys** (Bak.) De Vos, comb. et stat. nov.

Lapeirousia macrochlamys Bak., in J. Bot. Lond. N.S. 5: 338 (1876) (basionym). Type: Cape, without precise locality, *Hb. Forsyth* s.n. (K, holo.); Bak., in J. Linn. Soc. Bot. 16: 155 (1877), & in Fl. Cap. 6: 31 (1896) pro syn.

Ferraria crispulata L. Bol., in J. Bot. Lond. 69: 260 (1931). Type: Cape, Hondeklipbaai, Bowesdorp, *Bolus* 19162 (BOL, holo.; BM, K, iso.).

Lower leaves spreading, often somewhat falcate, to 150 mm long, $\times$ 3–10 mm, generally with strong, crisped or wavy margins. *Perianth segments* pale yellow (RHS 1D–9D), often with slightly darker yellow margins, outer segments with some bluish-green spots or a pale green median zone above the claws.

Distribution: Namaqualand, from Springbok to Garies, over a distance of about 120 km.

CAPE—2917 (Springbok): 1 ml W of Springbok (-DB), *Barker* 6701 (NBG); Near Springbok, *Lewis* 742 (SAM); 1 Meile südlich von Springbok, *Merxmüller & Giess* 3804 (M); 40 km SW of Springbok (-DC), *Goldblatt* 2877 (STE); Between Springbok and Kamieskroon (-DD), *Salter* 1444 (BM); Mesklip, *Lewis* 1035 (SAM); Near Darter's grave, *Lewis* 1376 (SAM).

—3017 (Hondeklipbaai): Grootvallei 20 km from Kamieskroon to Hondeklipbaai (-BB), *Thompson* 446 (STE); Skilpad, *Barker* 6820 (NBG); Grootvlei, *Lewis* 1375 (SAM), *Barker* 3746 (NBG); Bowesdorp, *Stokoe* SAM 25653, *Bolus* 19162 (BOL, BM, K), *De Vos* 2328 (STE); Kamieskroon, *Lewis* 5475 (NBG), *Thorne* SAM 48859; Brakdam (-BD), *Maguire* 963 (NBG); Twee Rivieren, Kamiesberg, *Pearson* 6822 (K); Garies hills (-DB), *Compton* 17179 (NBG), *Barker* 7406 (NBG); 6 mls N of Garies, *Leighton* 1369 (BOL).

Without locality: *Hb. Forsyth* s.n. (K).

This subspecies has flowers resembling that of *F. kamiesbergensis* and differs from the latter mainly in its strong, crisped or wavy leaf margins.

10. ***Ferraria brevifolia*** G. J. Lewis, in Ann. S. Afr. Mus. 40: 119 (1954).

Type: Cape, Vanrhynsdorp, 2 mls south of Nuwerus, *Lewis* 1374 SAM 57943 (SAM, holo.).

F. namaquensis Schlechter ined.

Icones: *Lewis* l.c.; this work Figs 26, 13B.

Plants 70–200 mm tall. *Corms* depressed globose or irregular, 10–30 mm diam., often in an irregular, almost horizontal row. *Stem* 60–150 mm long, covered with leaf sheaths. *Cataphylls* 2–3, sometimes reddish at their tips. *Foliage leaves* numerous, distichous, 50–100(–150) mm long, the lower ones spreading, leaf sheath longer and narrower than the obliquely ovate blade which is 7–15(–20) × 6–12 mm and has thickened margins and a slightly incurved, acute to obtuse tip. *Cymes* few. *Spathes* with incurved tips, outer spathe (35–)40–45 mm long, with somewhat reddish membranous margins, inner (45–)50–65 mm long, with pale margins. *Flowers* 30–60 mm long, sweetly scented, pale yellow (RHS 10A) or greenish-yellow. *Perianth* with overlapping claws forming a narrowly funnel-shaped cup 10–12 mm deep, 10–14 mm diam. at the rim; *nectaries* minute, pale green, basal on the claws, sometimes bilobed on the inner claws; *segments* with very long, slender, attenuate tip and orangy or fawn-yellow, slightly crisped margins; outer segments 33–40 × 8–10 mm, with a few green spots above the claws, inner slightly shorter, 4–6 mm wide, the claws very narrow. *Filament tube* 8–10 mm long, the upper free portions scarcely 1 mm long; *anthers* horizontal, with divaricate lobes, at first 3 mm long, later 1.5–2 mm × 2 mm, pollen pale yellow to orange-yellow. *Ovary* 20–30 mm long, with a rostrum ca. 8–12 mm long; *style* 8–12 mm long, the branches widened to 3 mm, shallowly bifid, with dense tufts of pale green fimbriae ca. 3 mm long; *stigmas* 1.5 mm long, grooved, sharply curved towards the anther lobes. *Capsule* 15–25 mm long, rostrate; *seeds* 3 mm diam., brown, shiny.

Chromosome number: $2n = 20$.

Flowering period: August to September. A flower remains open for two days.

Distribution: Southern Namaqualand, over a distance of about 80 km, from Garies to Nuwerus, in stony, sandy ground.

CAPE—3018 (Kamiesberg): Between Bitterfontein and Garies (–CA–C), *Lewis* NBG 2065/32 (BOL).

—3118 (Vanrhynsdorp): Nuwerus, stony veld (–AB), *Hall* 4114 (NBG, PRE), *Barker* 3734 (NBG); 2 mls S of Nuwerus, *Lewis* 1374 (SAM 57943), *De Vos* 2326 (STE); Bitterfontein, *Schlechter* 11031 (BOL, B, BM, BR, K, PRE, S, Z) sub *F. namaquensis* Schlechter, ined.

This is a very distinct species distinguished by its numerous, distichous, spreading leaves with a very short, obliquely ovate blade possessing conspicuously thickened, smooth margins, and by its pale yellow flowers resembling those of *F. kamiesbergensis* and *F. uncinata* subsp. *macrochlamys*. The filaments are not completely united as indicated by Lewis; they have very short free tips scarcely one millimetre in length.

EXCLUDED AFRICAN SPECIES

F. atrata Lodd., Bot. Cab. 14 t.1356 (1828). The description, as well as the figure (iconotype) is inadequate and the species cannot be identified.

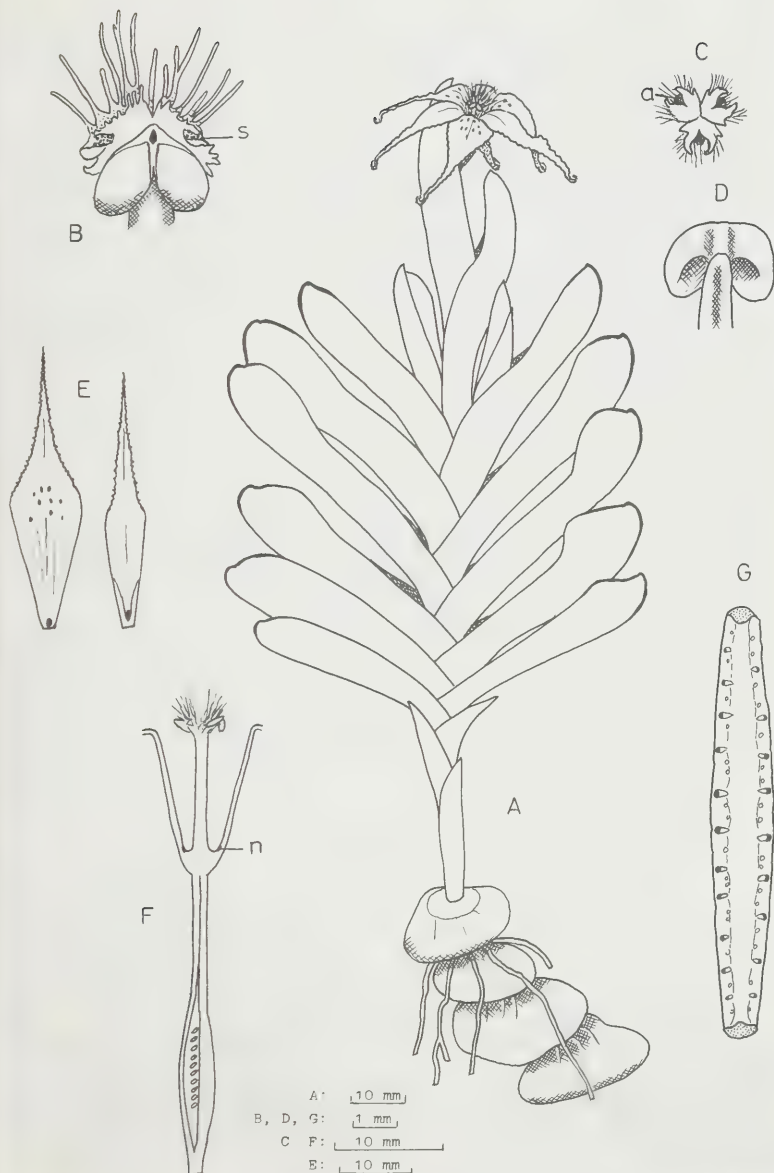


FIG. 26.

Ferraria brevifolia. A, plant; B, one style branch and anther, lateral view; C, style branches, top view; D, anther and free part of filament, adaxial side; E, outer (left) and inner (right) perianth segment; F, base of flower, longitudinal view; G, transverse section of short leaf blade; a, anther; n, nectary; s, stigma.

F. blanda Salisb., Prodr. Stirp.: 42 (1796). Salisbury named as synonym *Moraea indoides* L. which is an orthographic error for *M. iridoides* L. The latter is the type species of *Dietes* (Goldblatt 1976c: 695).

F. fimbriata Burm., Nova Acta Acad. Caes. Leop. Car. 2: 201 (1761). The description and figure (iconotype) are inadequate for identifying this species. Miller (1759b, 1768) misidentified it as *F. undulata*.

F. lugubris Salisb., Prodr. Stirp.: 42 (1796) is *Moraea lugubris* (Salisb.) Goldblatt (Goldblatt 1976c: 706).

F. ocellaris Salisb., l.c. p. 41 is *Moraea aristata* (Delar.) Aschers. & Graebn. (Goldblatt 1976c: 773).

F. tricuspis Willd., Enum. Hort. Berol.: 691 (1809) is, according to the *Index Kewensis*, *Vieusseuxia aristata* and *V. glaucopsis*, both so-called "peacock" moraeas, which are now *M. aristata* (Delar.) Aschers. & Graebn. and *M. villosa* (Ker) Ker (Goldblatt 1976c: 773, 775).

F. tristis Salisb., Prodr. Stirp.: 42 (1796) is *Moraea vegeta* L. (Goldblatt 1976c: 693).

EXCLUDED EXTRA-AFRICAN SPECIES

According to the *Index Kewensis* e.a. the following belong to different genera:

F. cathartica Mart., Reise Bras. 1: 548 is *Trimezia juncifolia* B. & H.f.

F. crocea Salisb., Prodr. Stirp.: 41 (1796) is *Belamcanda punctata* Moench.

F. elegans Salisb., l.c. p. 42 is *Marica northiana* Ker.

F. elongata R. Grah., in Edinb. N. Phil. J. 1830: 173. This is probably *Gelasine azurea* Herb., in Curtis's bot. Mag. t.3779 (1840), according to B. L. Burtt (private communication). The epithet *elongata*, however, antedates *azurea*.

F. ixioides Willd., Sp. Pl. 3: 582 (1800) is *Libertia ixioides* Spreng.

F. lahue Molina, Sagg. Stor. Nat. Chile ed. 2 p. 110 (1810) is *Herbertia lahue* (Molina) Goldblatt, in Ann. Mo. Bot. Gdn. 64: 379 (1976).

F. lurida Salisb., Prodr. Stirp.: 41 (1796) is *Trimezia lurida* Salisb. (1812).

F. ochroleuca Salisb., l.c. p. 42 is *Sisyrinchium striatum* Smith.

F. parviflora Salisb., l.c. p. 43 is *Eleutherine plicata* Herb.

F. pavonia L.f., Suppl. p. 407 (1781) is *Trigridia pavonia* (L.f.) DC.

F. plana Larranaga, Escritos D. A. Larranaga 2: 212, in Publ. Inst. Hist. Geog. Urug. (1923). According to Dr H. S. Osario, Museo de Historia Natural, Montevideo, Larranaga's herbarium was lost in the past century. Judging from the description, this is not a *Ferraria* species.

F. plicata Larranaga l.c. See note under *F. plana*.

F. pulchella Salisb., Stirp.: 42 (1796) Prodr. is *Sisyrinchium angustifolium* Miller.

F. purgans Mart., Reise Braz. 1: 547 is *Trimezia juncifolia* B. & H.f.

F. pusilla Link & Otto, Ic. Pl. Select. 125 t.59 (1820-28) is *Cypella pusilla* B. & H.f.

F. tigridia Sims, in Curtis's bot. Mag. 15 t.532 (1801) is *Tigridia pavonia* (L.f.) DC.

F. violacea Salisb., Prodr. Stirp.: 42 (1796) is *Sisyrinchium bermudiana* L.

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